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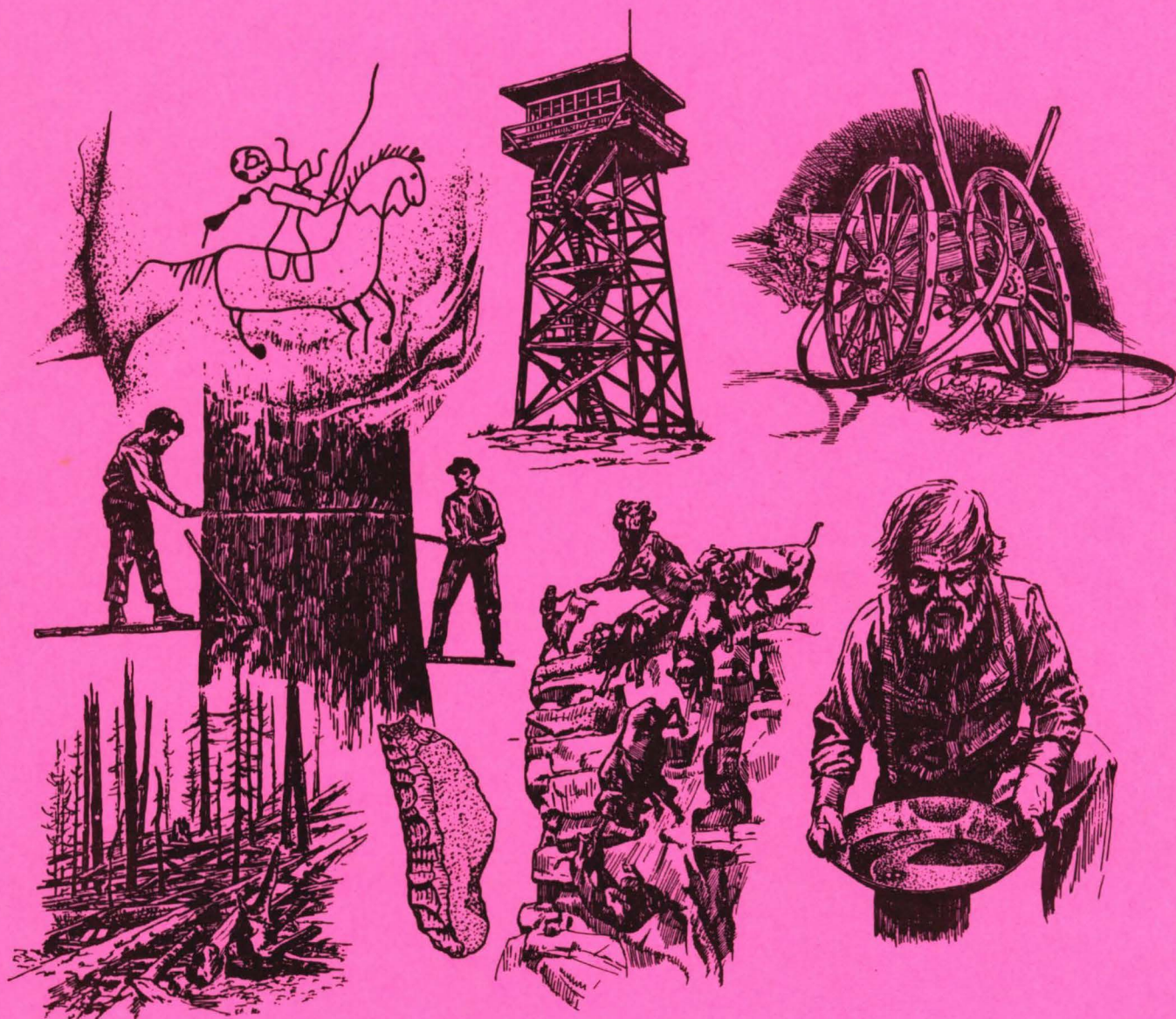
Cultural Resources

The Abraxas Project: Archaeological Mitigation at Sites 32M2333 and M32M2334

by

Report No. 9

Mervin G. Floodman, Marcia J. Tate, and
Robert A. Williams



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ARCHAEOLOGICAL INVESTIGATIONS AT PREHISTORIC SITES
32MZ333 AND 32MZ334, MCKENZIE COUNTY, NORTH DAKOTA.

Mervin G. Floodman, M.A.
Marcia J. Tate, and
Robert A. Williams

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McKENZIE COUNTY, NORTH DAKOTA

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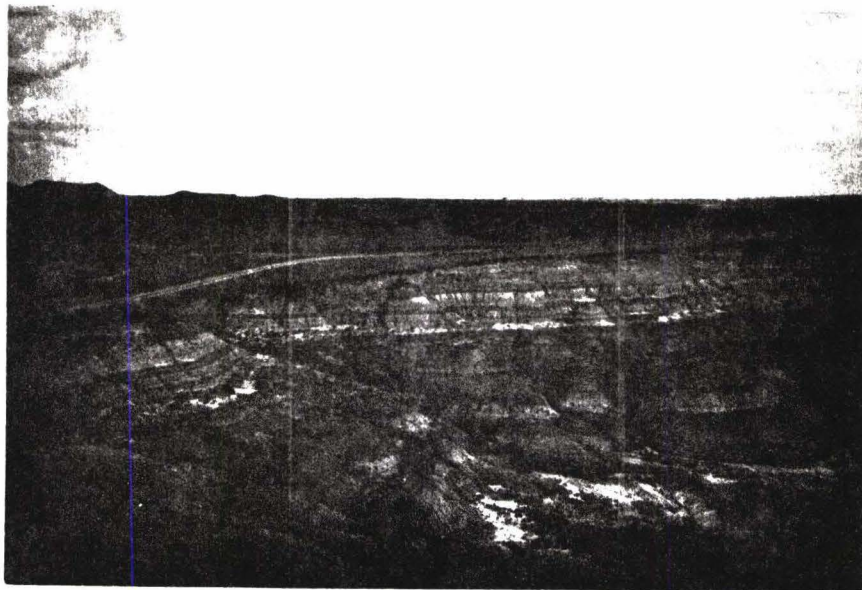
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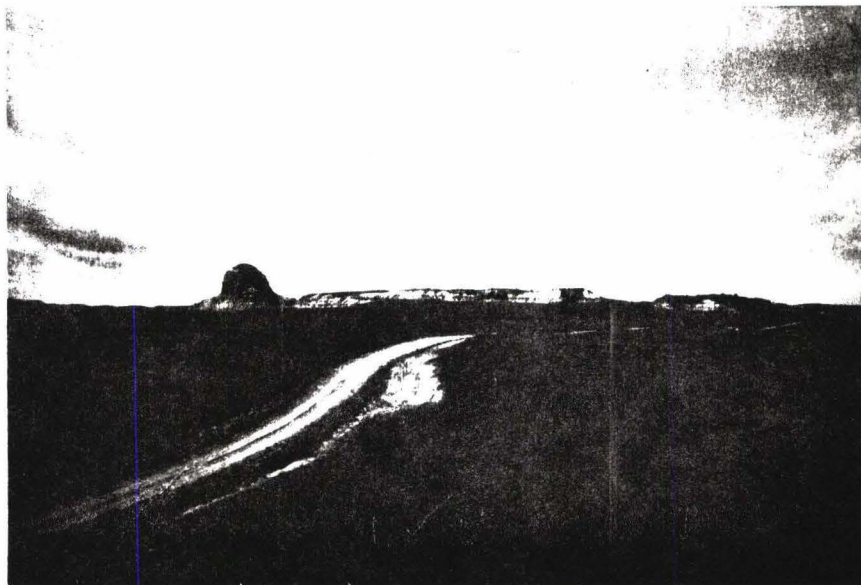
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32MZ333



32MZ334

THE ABRAXAS PROJECT; ARCHAEOLOGICAL MITIGATION
AT SITES 32M2333 and M32M2334

By

MERVIN G. FLOODMAN, MARCIA J. TATE, and
ROBERT A. WILLIAMS

United States
Department of Agriculture
Forest Service
Northern Region
Report No. 9

FOREWORD

This report was prepared under contract to the Abraxas Petroleum Company by employees of the Archaeology Division, Powers Elevation Company. Region 1 of the Forest Service is pleased to publish archaeological investigations conducted on National Forest land by outside contractors.

The search for Truth is in one way hard and
in another easy. For it is evident that no one
can master it fully nor miss it wholly. But
each adds a little to our knowledge of Nature,
and from all the facts assembled there arises
a certain grandeur.

—Aristotle

Met. A.10:993.A.30
Lintel, The National
Academy of Sciences

ABSTRACT

Powers Elevation conducted excavations at two sites in the Little Missouri Badlands during the 1982 field season. Sites 32MZ333 and 32MZ334 were discovered in 1980 by archaeologists in the course of an intensive inventory of a proposed well location and access road. An initial phase of testing was conducted in 1981 by UNDAR-West. Inadvertent disturbance of portions of both sites and planned road construction activities necessitated further investigations to mitigate these impacts.

Powers Elevation's investigations were performed on behalf of Abraxas Petroleum, in consultation with the U.S. Forest Service and the State Historic Preservation Officer. The work was guided by a research design developed from the USFS Scope of Work. Transects of shovel probes were placed across each site, and productive probes were expanded into formal 1 x 1 meter units. Larger block excavations, up to 4 x 4 meters, and profile cuts were then placed, based on the probing results, the previous investigations, and the research design.

Three cultural horizons were revealed at each site. No datable materials or diagnostic artifacts were recovered at 32MZ334, so no absolute chronology of that site can be constructed at this time. Site 32MZ333, however, yielded both time diagnostic artifacts of Late Archaic age (projectile points and ceramics). Materials recovered from this site yielded nine absolute dates by radiocarbon and obsidian hydration methods, ranging from ca. 2270 B.P. (320 B.C.) to ca. 215 B.P. (A.D. 1735). These dates are correlated with geomorphological and palynological data on the changing physical environment of the Badlands.

Both sites appear to have functioned as periodically re-occupied temporary camp sites, probably related to hunting or other local food source utilization. Site activity areas include concentrations of debitage from late stages of tool manufacture and maintenance and hearths, probably serving as roasting or baking pits. Association of the upper component of 32MZ333 with a nearby bison bone bed is also suspected. Measures have been devised by the USFS to allow road construction to proceed without further impact to the sites. However, both sites offer potential for further significant information on the regional cultural chronology and human adaptations to the Little Missouri Badlands, and further work will be necessary prior to future impacts.

Acknowledgements

Although we alone are responsible for the final content and tone of this report, Powers Elevation is very pleased to recognize, with considerable and sincere thanks, the contributions of many other companies, agencies, and colleagues.

Abraxas Petroleum Corporation, in the person of LeRoy Wessel, and Richard H. Gifford, Incorporated, represented by Richard H. Gifford, our clients who paid for this public effort, have cooperated cheerfully with us in every way.

The United States Forest Service, Administrators of the Little Missouri National Grasslands, in the person of McKenzie District Ranger James Fishburn, set the stage for the project by treating its portion of North Dakota's prehistory as an important, protected resource. Walt Allen, the McKenzie Ranger District Archaeologist, and Michael Beckes, then Eastern Zone Archaeologist, now Custer National Forest Archaeologist, developed a careful, comprehensive, and solid proposal for mitigation of these two archaeological sites by state-of-the-art data recovery. Continually, they monitored and assisted the accomplishment of the necessary work with finesse and good humor. Numerous other Forest Service personnel spring to mind, including another archaeologist, Tom Burge, and various environmental specialists.

For the State of North Dakota, Chris Dill, Chief Archaeologist and representative of James Sperry, the State Historic Preservation Officer, visited the excavations repeatedly, always offering his considerable insight and help.

Many other individuals of diverse affiliations must be recognized: John Albanese (Consulting Geologist) for his geomorphological studies, Ann Johnson (Consulting Archaeologist) for her ceramic analysis and text review, Steve Chomko (Paleo-Environmental Consultants) for faunal analysis, Linda Scott (Palynological Analysts) for the palynology, Joe Michels (MOHLAB) for the obsidian hydration dating, and Jerry Stipp and Murry Tamers (Beta Analytic) for the C-14 dating, and our colleagues Mike Gregg (UNDAR) and Dale Davidson (BLM-Dickinson).

Lastly, I thank the Powers Elevation staff: Mervin Floodman who directed the fieldwork and is the primary author;

Marcia Tate who also authored and led the editing, assembly, and organization of the report; Bob Williams who did yeoman duty likewise; Jane King who assisted in editing; Linda Barrows, Sara Roberts, Mary Karavites, and Bridget Wells who typed the report; Bill Metz, Greg Newberry, Nick and Pat Franke, Dale Wedel, and George Ramsay who were field crew members; and Greg, George, and Bob, named above, who also did the graphics.

As it was in ancient Sumer or 32MZ333, projects--such as this one in archaeology, oil and gas, and government--exist and bear fruit only by far-reaching teamwork. It is a pleasure to acknowledge this.

--Bruce E. Rippeteau, Ph.D.
Principal Investigator

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1.0 INTRODUCTION

In the fall of 1981, the University of North Dakota Archaeological Research (UNDAR) West conducted archaeological investigations at Sites 32MZ333 and 32MZ334, located in the McKenzie Ranger District of Custer National Forest. This investigation comprised an initial phase of testing designed to assess the sites' significance and to salvage cultural resources, if necessary, prior to impact from increased traffic on the existing trail. This testing, in addition to the assessment of U.S. Department of Agriculture Forest Service (USFS) archaeologists who subsequently visited the sites, indicated that the sites possessed a high potential of yielding information significant to the understanding and interpretation of the badlands/grasslands region of western North Dakota (Borchert et al. 1982).

The UNDAR-West testing program established the presence of intact, buried cultural horizons, also demonstrated in cutbank occurrences at both sites. Unknown, however, were the horizontal and vertical extent of cultural occupations(s) and the extent and nature of the construction impacts upon these cultural manifestations.

When subsequent road construction activities inadvertently disturbed portions of both sites, Dr. Michael Beckes, USFS, prepared a new Scope of Work designed to effect remedial mitigation due to the adverse impact by addressing the above questions. Undertaken by Powers Elevation and reported herein, field work included a phased testing program of shovel probes through the impacted site perimeters and subsequent formalized 1 x 1 meter testing based upon the results of the probes. Additionally, the excavation of two 4 x 4 meter units and a detailed profile/excavation of the apparent multiple strata along a large, eroding cutbank face were conducted at Site 32MZ333 (USDA Forest Service, 1981, Tate et al. 1982).

Field work was followed by lithic, palynological, faunal, geomorphological, and chronometric analyses. Ceramic analysis of previously recovered ceramic remains (Borchert et al. 1982) was also performed (see Johnson, Appendix 7.3).

Bruce E. Rippeteau, Ph.D., served as Principal Investigator. The Project Archaeologist, Mervin Floodman, M.A., directed all field work. Production Manager Marcia J. Tate and

Project Administrator, Robert A. Williams, assisted Mr. Floodman in the synthesis of data, report writing, and production. Mr. Williams and Project Administrator Jane King coordinated many of the logistical aspects of the investigation. Ms. King also assisted in editing and production.

Under the direction of Mr. Floodman, field work was performed from June 7 through July 14, 1982. The archaeological crew included crew chief William Metz and crew members Gregory Newberry, Nick Franke, Pat Franke, George Ramsay, and Dale Wedel.

The following archaeological and interdisciplinary specialists were consulted during the course of the field work and for subsequent appropriate analyses: Murry A. Tamers and Jerry J. Stipp of Beta Analytic, Inc., for C-14 dating. Joseph Michaels of MOHLAB performed obsidian hydration dating, and Linda Scott of Palynological Analysts provided flotation and palynological analysis. John P. Albanese, consulting geologist, provided geomorphology while Stephen A. Chomko of Paleo-Environmental Consultants performed osteological analysis. Ann M. Johnson, consulting archaeologist, provided ceramics analysis.

1.1 PHYSICAL SETTING

Archaeological Sites 32MZ333 and 32MZ334 are located in western North Dakota, within the jurisdiction of the McKenzie Ranger District of the Little Missouri National Grasslands, Custer National Forest (Figure 1).

The Little Missouri Grasslands comprises over 1,027,000 acres of prairie grasslands and badlands extending a distance of about 140 miles north-south, from the Missouri River to Bowman, North Dakota. The Montana state line forms the western boundary while the eastern borders of McKenzie, Billings, and Slope Counties form its approximate eastern limit (Loendorf 1978, Lau 1981).

The Grasslands are located on the Missouri River Plateau within the Great Plains physiographic province (Fenneman 1931). The area can be described as containing nine principal ecosystems based upon topography, soils, and vegetation (Stewart and Stewart 1973). Generally, these range from the bottomlands of streams and rivers, to badlands areas and grasslands. Specifically, the ecosystems described are bottomland, terraces, toe slope, scoria, badland, upland grassland, rolling grassland, hardwood draw, and freshwater marsh.

Figure 1. Project Vicinity Map (after Wilkins and Wilkins 1977)

The Badlands of western North Dakota are located along the Little Missouri River drainage and present a sharp contrast to the characteristic rolling prairie of the region. The topography of the project area is badlands mixed with rolling grasslands. A rectangular network of ephemeral streams incises the area creating a series of bedrock ridges which trend northwest-southeast (Albanese, Appendix 7.6).

Geology

The Badlands are located within the Williston Basin, a structural and sedimentary basin covering 518,000 km² in western North Dakota, eastern Montana, northwestern South Dakota, southwestern Manitoba, and southern Saskatchewan. The sedimentary rock sequence of the basin ranges in age from the Tertiary to the Cambrian and overlies a complex of Precambrian igneous and metamorphic rock (Lau 1981, Kuehn 1982).

Following the Precambrian, sediments of sand, shales, and clays were laid down as southwestern North Dakota was submerged by inland seas. Kuehn (1982) notes that the oldest exposed geologic formations in the Badlands are the Cretaceous Pierre shale, Fox Hills sandstone, and the Hell Creek formation, which are seen only rarely (Petter 1956).

The most exposed formation, deposited to a depth of 2,000 feet, is the Fort Union group composed of the Ludlow, Bullion Creek, and Sentinel Butte formations. These consist of horizontally bedded sandstone, loose shales and sands, silts, clays, and lignite beds. At this time southwestern North Dakota was a rolling upland area dissected by the Little Missouri River, flowing north to its confluence with the Missouri River, and thence into Hudson Bay. During the remainder of the Tertiary the sedimentary Golden Valley, White River, and Arikaree formations were deposited and eroded (Petter 1956, Lau 1981). Remnants of both the Golden Valley and White River formations are yet visible in limited areas.

During the Pleistocene the Canadian ice sheet began a series of advances and retreats, depositing glacial sediments over much of North Dakota. The intrusion of glaciation in northern North Dakota resulted in the rerouting of the courses of the Little Missouri, Yellowstone, and Missouri Rivers. The Little Missouri was diverted eastward and its gradient was greatly increased by the new, shorter course. The increased gradient initiated the headward erosion of the Little Missouri's tributaries and the downcutting that are primarily responsible for forming the Badlands (Bluemle 1977).

Erosional forces such as sheet runoff, landslides, and mass-wasting of weathered slopes further contributed to the formation (Schmitz 1955, from Kuehn 1982) of the heavily dissected Badlands terrain from which less resistant strata had been removed, leaving ridges and buttes of relatively resistant materials such as sandstone, limestone, and scoria. Simon (1982) hypothesizes that the clusters of sites in the general project area are evidence of ridgeline travel routes for past groups moving between the Yellowstone and Little Missouri Rivers. She explains that the ridge systems provide access to resources in the drainages, and passage through this difficult terrain.

From about 10,000 B.C. until 8,000 B.C. a spruce-aspen forest covered western North Dakota. This woodland was replaced by tallgrass prairie as the climate became warmer and drier. The following 4,000-year period of the Altithermal drought (Antevs 1955) saw increased erosion. Since about 500 B.C. conditions have been similar to the present (Moran et al. 1976 and Bluemle 1975, from Kuehn 1982).

According to Albanese (Appendix 7.6), the Fort Union formation constitutes bedrock in the study area. At Site 32MZ333, which is situated on the crest of a small, steep-sloped ridge, he found bedrock exposed over half of the site area and the remainder of the site surface covered by thin Holocene, post-Altithermal soils extending to a depth of 1.2 m. Albanese describes the Fort Union lithology as grey shale grading to tan shale, thin coals, tan bentonite, and finally, thin lenses of grey and brown siltstone.

At Site 32MZ333 Albanese identified four geomorphic surfaces underlain by post-Altithermal sediment: the main ridge crest, underlain by eolian sand 62-107 cm deep, and three Holocene terraces bordering the nearby ephemeral streams. He noted two soils developed on the eolian sand unit. These he labeled P5 and P4 in ascending order.

The P5 unit is the oldest, extending to bedrock, a maximum depth of 95 cm, and is restricted to the crest of the main ridge. This unit developed after the Besant occupation; it is younger than 1600 B.P. The P4 soil comprises the surface soil over much of the main crest, is 18-25 cm deep and is dated to the Late Prehistoric period based upon associated artifacts. According to Albanese, the geomorphology and soil relationships indicate the bison bone accumulated in the younger soil which developed after the Besant occupation, and therefore dates to the Late Prehistoric period.

Albanese (Appendix 7.6) concludes that the ground surface has changed considerably since the Besant occupation. Much

of the slope next to the ridge on which the site is located has eroded and the stream channels nearby have lowered over 6 meters since that time. He notes that during the Besant occupation the surface was more undulating with less severe slopes and stream beds were in swales instead of arroyos as they are today. The climate was semi-arid, followed by a wet cycle which produced the P5 soil. The generally more arid climate until the present produced a deepening of stream channels due to the lowered ground water table.

Climate

The present Badlands climate is classed as semi-arid and is characterized by broad seasonal temperature variations with relatively little precipitation. Overall, temperatures range from -37°C to +38°C. The low monthly average of -11°C is in January while the high monthly average of +22°C is in July. Of the 380 mm average annual precipitation, half results from summer rainfall, often in the form of severe thunderstorms; average annual snowfall is 760 mm. In combination with the low temperatures noted above and with constant blowing wind, severe winters result (USDA Forest Service 1974).

Flora

The project area is within the mixed grass prairie which comprises western North Dakota. The dominant vegetation at Sites 32MZ333 and 32MZ334 consists of a heavily grazed shortgrass prairie and sage mix. Common species are sage (Artemisia sp.), grama grass (Boutelous sp.), Missouri goldenrod (Solidago missourensis), small prickly pear (Opuntia fragilis), buckbrush (Symphoricarpo occidentalis), hawthorne (Crataegus chrysocarpa), and Rocky Mountain juniper (Juniperus scopulorum).

Vegetation along water drainages and draws in the area include Rocky Mountain juniper, cottonwood (Populus deltoides), boxelder (Acer negundo), buffaloberry (Hepargyrea argentea), hawthorne, aspen (Populus tremuloides), and buckbrush (Borchert et al. 1982).

Scott (Appendix 7.5) notes that the present vegetation of the project area provides a good model for the sites' paleo-environment. The pollen record over the past 2,300 years indicates a floral community dominated by shortgrass prairie and sagebrush throughout the known occupation of the area, much as is present today, but with shifts in the relative composition through time. These shifts in the proportions of species present at any time she attributes to both cultural and environmental variables.

Scott's analysis (Appendix 7.5) of macro-floral remains based on flotation of hearth fill materials at Site 32MZ333 indicates that root baking activities may have occurred at the site, based upon the presence of burned grasses such as may be used in the preparation of roasting pits. She further notes a lack of evidence for seed preparation activities.

Fauna

The Grasslands provides habitat for over 200 species of mammals, birds, reptiles, and fish (Stewart and Stewart 1973, USDA Forest Service 1974).

Investigators at the sites in 1981 observed a variety of fauna and/or faunal activity within the general area (Borchert et al. 1982). Mammals in the area included antelope (Antilocapra americana), white-tailed jackrabbit (Lepus townsendii), desert cottontail (Sylvilagus audubonii), coyote (Canis latrans), least chipmunk (Eutamias minimus), mule deer (Odocoileus hemionus), raccoon (Procyon lotor), badger (Taxidea taxus), and ground squirrel (Spermophilus spp.).

Birds in the area of the two sites included marsh harrier (Circus cyaneus), mourning dove (Zenaidura macroura), Western meadowlark (Sturnella neglecta), Eastern meadowlark (Sturnella magna), black-billed magpie (Pica pica), prairie horned lark (Cremophila alpestris), loggerhead shrike (Lanius ludovicianus), sharp-tailed grouse (Pediacetes phasianellus), and the black-capped chickadee (Parsus atricapillus).

During the 1981 investigation, the single reptile observed was the bullsnake (Pituophis catenifer sayi). During the 1982 investigation, the Project Archaeologist and field crew were very wary of the presence of a large den of prairie rattlesnakes (Crotalus viridis viridis) observed earlier by USDA Forest Service personnel in the vicinity of Site 32MZ333.

Fauna not observed, but known to inhabit the Grasslands, include bighorn sheep (Ovis canadensis), beaver (Castor canadensis), black-tailed prairie dog (Cynomys ludovicianus), and the golden eagle (Aquila chrysaetos) and other raptors, among others.

Those faunal remains recovered in an archaeological context at Site 32MZ333, and identifiable, include burned antelope bone and unburned bison bone (Chomko, Appendix 7.4).

1.2 DESCRIPTION OF THE SITES

Archaeological sites 32MZ333 and 32MZ334 are located in west central McKenzie County, North Dakota, more precisely in the NE $\frac{1}{4}$ of Section 25, T148N, R103W, and in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 5, T147N, R102W, of the Fifth Prime Meridian, respectively. The sites and the surrounding area are found on the Burning Mine Butte, North Dakota 7.5 minute, 1972 USGS topographic quadrangle (Figure 2).

Site 32MZ333

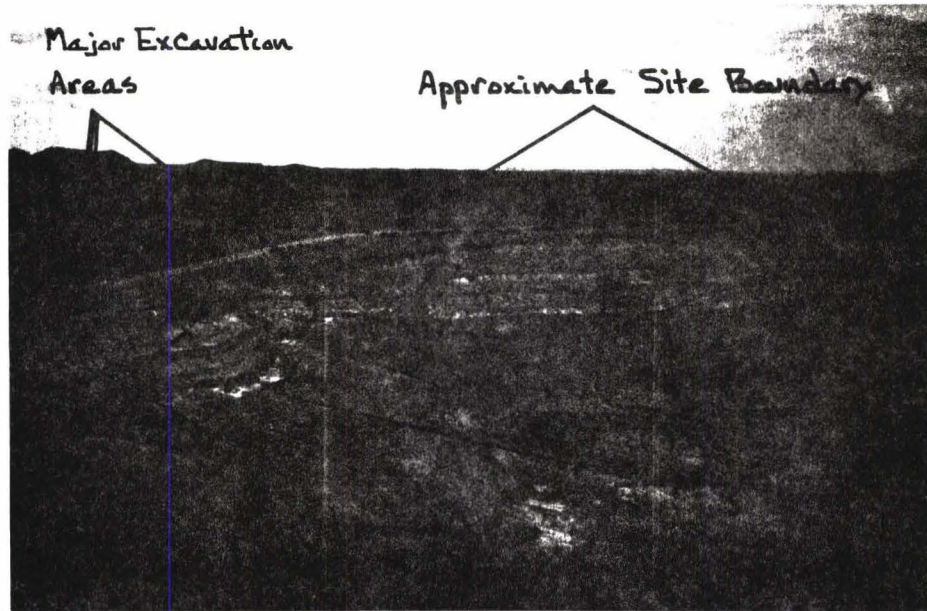
Site 32MZ333 (Plate 1a) is located near the headwaters of two large intermittent stream systems which dominate the immediate site vicinity. The site lies along a high upland ridgetop which serves as a divide area between the two creek systems at an average elevation of about 2,460 feet (750 m) (Figure 3). The intermittent streams and draws west of 32MZ333 form the headwaters of Sheep Creek which flow south-southwesterly to Bennie Peer Creek and subsequently west to the Yellowstone River. East of the site area lie the headwaters of the North Branch of Bowline Creek which flows east-southeast to the Little Missouri. The site itself is situated approximately seven miles (11 km), in a straight line, northwest of the Little Missouri River, while the meandering stream courses are much longer.

The site, as defined, consists of an area approximately 500 meters northwest-southeast by 250 meters northeast-southwest and straddles the ridgetop covering two predominant high knolls, one along the western boundary of the site and one along the southern border just east of the deeply eroded draw separating the knolls. A two-track trail (now upgraded for oil development) runs through the site along the small saddle north of the western knoll and along the northern backslope of the eastern knoll.

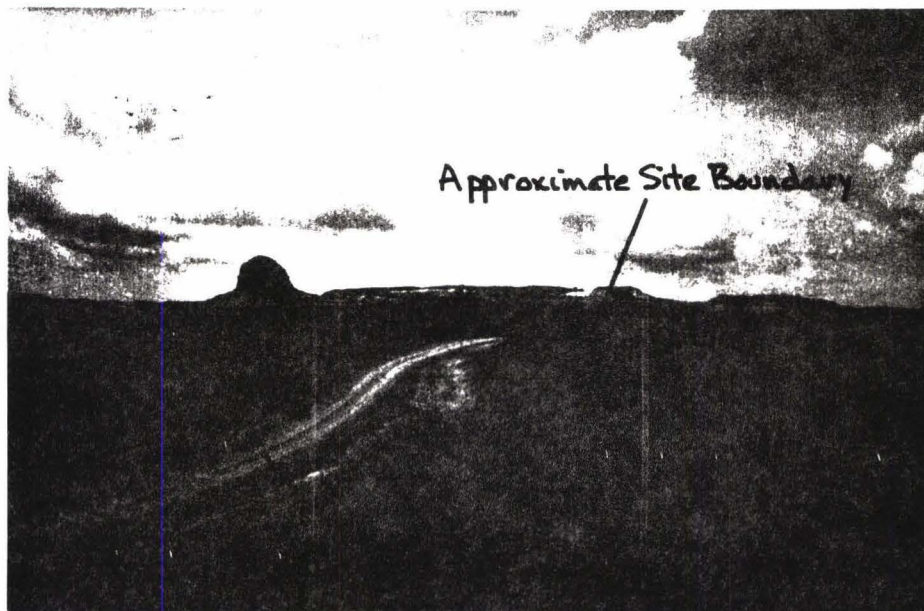
Predominant vegetation at the site is medium and short prairie grasses, prickly pear cactus, sagebrush, prairie turnip, and a wide variety of wild flowers and forbs. This vegetation forms a dense mat obscuring visibility of the site ground surface over most of the site area.

Soils in the area consist of loams and sandy loams of probable eolian deposition. The site area exhibits, basically, two soil zones. The first is a much older, well-developed prairie/sod soil zone visible in cutbanks and test units

Plate 1



1a. 32MZ333 Central site area, general view east



1b. 32MZ334 Site area looking northwest

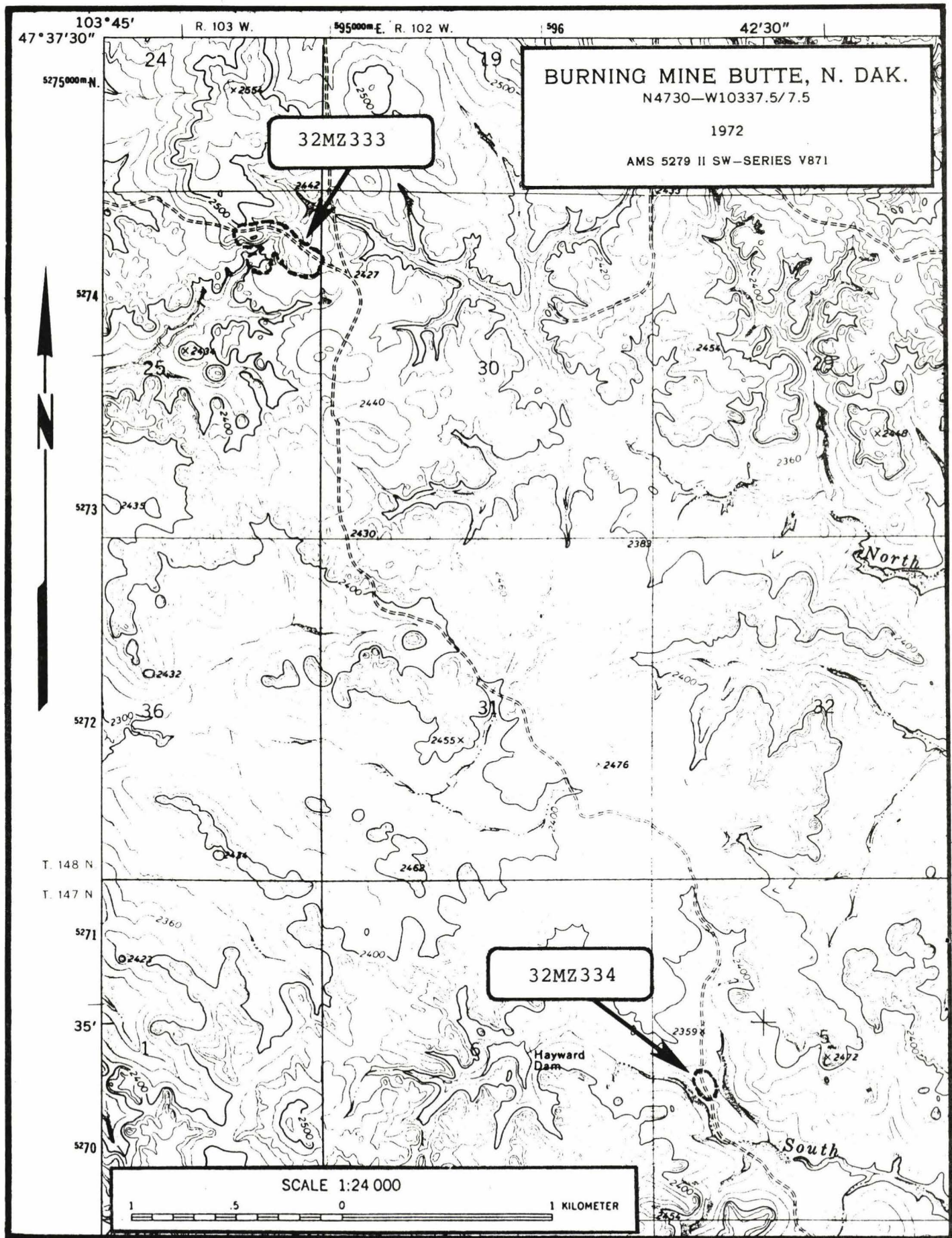


Figure 2. Site Location Map

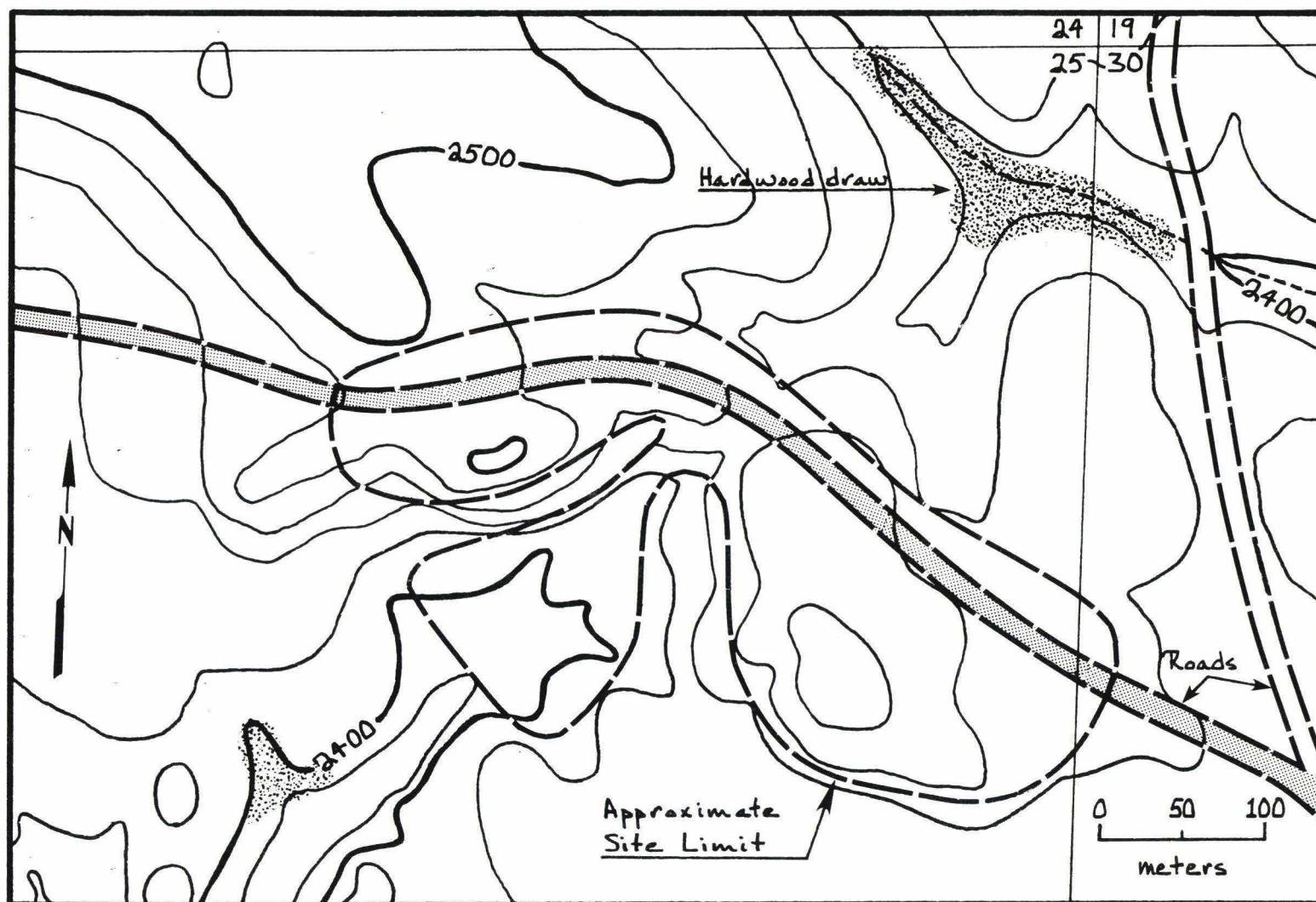


Figure 3. Site 32MZ333: Contour map and approximate site boundary. Base map from USGS, Burning Mine Butte, N. D., 7.5' quad, 1972; and Borchert, et al. 1982.

through the main site area and is remnant as a buried paleosol found only on the two high knolls present over the site area. This soil is a dark brown loam whose age is manifested by the presence of caliche stains throughout the paleosol and just beneath. This soil is much thicker and buried much deeper along the southern border of the site. It has been eroded to thinner zones and is present just under the surface sod along the northern border of the main site area. The second soil zone consists of a much more recent and poorly developed sandy loam, light brown in color. This soil is also much thicker along the southern border of the main site area and has been eroded to a thinner zone to the north. It is not present at all along the northern border of the main site area where the paleosol exists just under the surface. Underlying these soils are bedrock paleocene sediments and sandstones of the Sentinel Butte geologic formation.

The site was first observed and recorded in areas of erosion and disturbance by the existing east-west two-track trail (Persinger 1980). The site was characterized by a moderate to heavy scatter of lithic debris along the trail and eroding cutbank faces. A small amount of fire-cracked rock was also observed. Bone was observed eroding from the cutbanks in situ at 35 cm below ground surface (BGS) as well as lithic materials at the same depth. One stone bead, six biface fragments, two endscrapers, 20 utilized flakes, one projectile point (untyped), and more than 200 pieces of lithic debris were noted. Also observed during the initial survey were several bison bones, some articulated, eroding from the area of the deeply cut draw located between the two high knolls. Flakes and bifaces were also observed scattered among the bones and eroding from small eroded tables with remnant soils from the lower draw area. The presence of these bison bones and associated cultural materials resulted in the site's being recorded as a bison jump with an associated camp. The site recommendations called for testing prior to impact to assess the site significance and potential eligibility for the National Register of Historic Places based upon the apparent presence of intact, undisturbed cultural horizon(s) (Persinger 1980).

Later testing of the site in 1981 by UNDAR-West (Borchert et al. 1982) confirmed the presence of intact, buried cultural horizons adjacent to the road disturbance corridor. Cultural materials recovered included a small corner-notched

projectile point and several pottery sherds tentatively identified as Woodland. These materials apparently were recovered from the dark paleosol and older soil horizon present at the site. Limited testing at other areas of the site produced insignificant results.

Site 32MZ334

Site 32MZ334 (Plate 1b) is located approximately three miles (five km) east and south of 32MZ333 along the existing trail and upgraded roadway (Figure 2). The site lies on a small peninsular terrace between two intermittent streams forming the headwaters of the south branch of Bowline Creek at an average elevation of 2,350 feet (716 m). The site lies approximately 4.25 miles (7 km) northwest in a straight line from the Little Missouri River.

The site, as defined, consists of an area approximately 100 meters in diameter covering the small, rolling terrace. The dominant landmark in the area is a small, rounded butte just southwest of the site area. The two-track trail/road crosses north-south through the site area across the terrace (Figure 4).

Again, the site area is dominated by shortgrass prairie, prickly pear cactus, sagebrush, and a wide variety of forbs. The vegetation obscures ground visibility, confining surface exposure to erosion/deflation areas and the existing road cut. The soils of the site consist of sandy loams of eolian derivation. The higher, eastern portion of the site consists of deep (60 to 90+ cm), undifferentiated medium-to-coarse sands overlying the basal bedrock formations. The western portion of the site lies on a small terrace remnant of lower elevation exhibiting a developed soil horizon/stabilization zone at 15 to 20 cm BGS. Above and below this horizon exist sandy loams, light to dark brown in color. Underlying this portion of the site are sandstones and clays, also of the bedrock Sentinel Butte Formation.

The site was first observed and recorded in areas of disturbance along the existing two-track trail across the terrace top (Persinger 1980). Fire-cracked rock, quartzite debris, white chert flakes, and Knife River flint (KRF) retouch flakes were observed eroding from the soil zones.

The site was characterized as a low density lithic scatter (predominantly chert) of unknown temporal or cultural

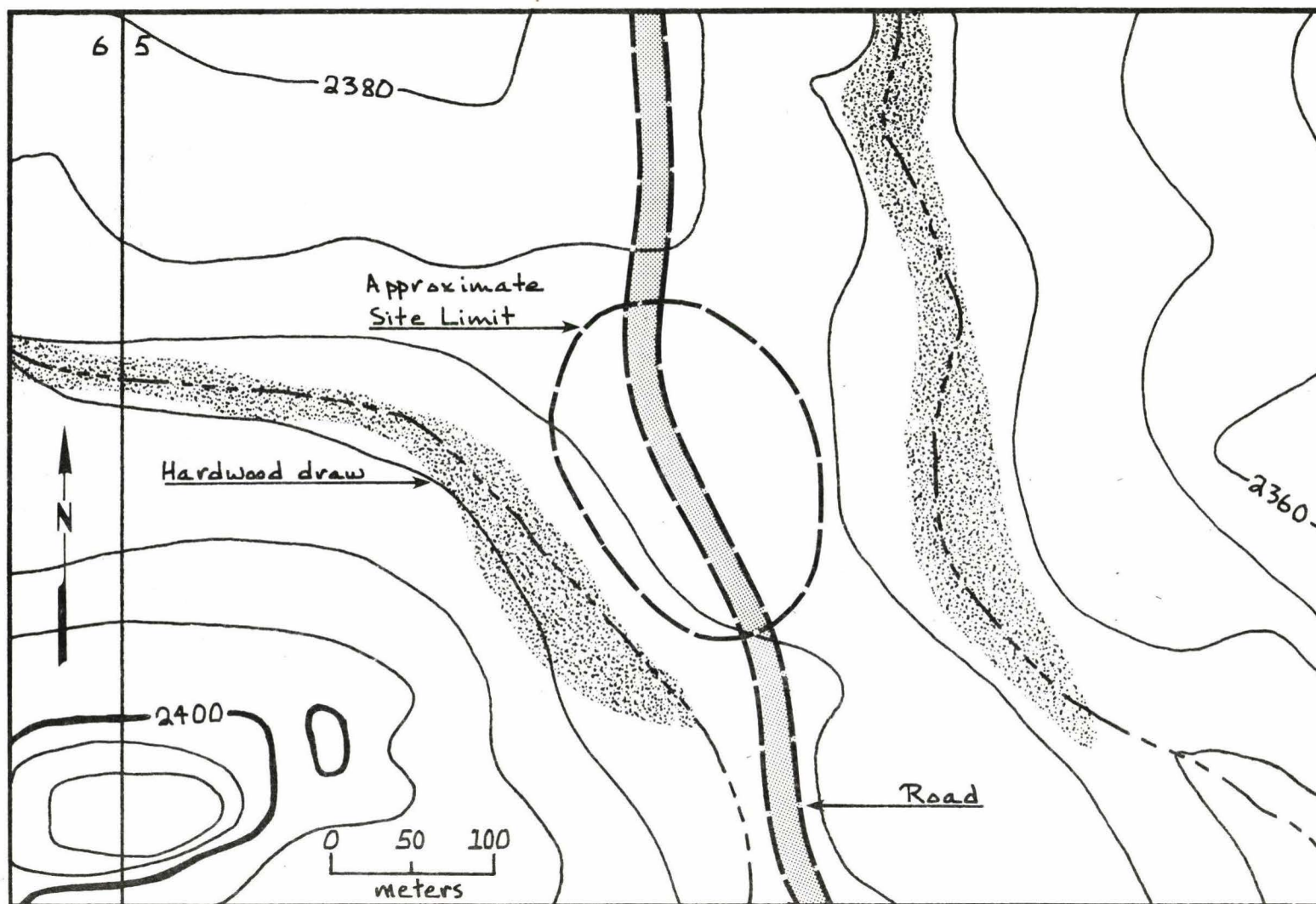


Figure 4. Site 32MZ334, Contour map and approximate site boundary. Base map from USGS, Burning Mine Butte, N. D., 7.5' quad, 1972; and Borchert, et al. 1982.

affiliation, and appeared to be significant because materials were eroding from the roadway, indicating good potential for buried cultural materials. Monitoring of the site area during road improvements was subsequently recommended.

Preliminary testing by UNDAR-West in 1981 (Borchert et al. 1982) revealed the presence of a fire-cracked rock hearth feature and associated flaked stone debitage but no culturally diagnostic artifacts or datable materials. Evidence recovered from this initial testing within the road right-of-way suggested a single component site of unknown cultural affiliation.

1.3 HISTORY OF PREVIOUS RESEARCH

Archaeological sites 32MZ333 and 32MZ334 were originally located during a Class III Intensive Inventory of the Pennzoil Fork Lake Prospect (NE¼, Section 31, T148N, R102W) conducted on the McKenzie Ranger District, Custer National Forest in 1980 by Archaeological Services (Persinger 1980).

Prior to planned road construction activities, a testing program was defined by the USFS in consultation with the State Historic Preservation Office and undertaken by UNDAR-West on behalf of Abraxas Petroleum in the fall of 1981.

Based primarily on surface manifestations of fire-cracked rock, three artifact concentrations (Areas A, B, and C) were delineated at Site 32MZ333, all within the road cut. A fourth locus, Area D, was defined on the basis of bison bones eroding from a cutbank (Borchert et al. 1982).

Area A was surface collected before testing. Bison bone was also collected from the eroded washout surface of Area D. Testing included placing a series of 1 x 1 meter test units in Areas A, B, and C, and a single unit on the summit crest directly above the washout in Area D. Additionally, auger and shovel test probes were placed at various locations throughout the site.

Materials collected from the surface of Area A included a quartzite hammerstone, flakes (utilized and non-utilized) of KRF, fire-cracked rock, and a single bone fragment. Fifteen bison bones and bone fragments were collected at the end of eroded washouts in Area D.

Testing in Areas B, C, and D was largely unproductive (a single flake in Area B, Level 1). In Area A, Levels 1 and 2 produced eight potsherds (one identifiably cordmarked), a small corner-notched projectile point of KRF, fire-cracked rock, and flakes of KRF and red-brown chert. No cultural materials were located in subsequent levels.

The investigators concluded that data resulting from testing in Areas B, C, and D were too sparse to generate comments concerning cultural implications in these areas or to describe the nature of the bison bone deposition. From the information obtained in Area A, Borchert et al. (1982) inferred a number of activities, concluding that the area may represent a base camp.

At Site 32MZ334, surface inspections in the exposed road cut revealed two artifact concentrations and a stone feature. Surface materials collected before testing included fire-cracked rock, a quartzite anvil stone, and flakes (mainly of porcellanite).

Test units were placed in Concentration 1 (1 x 1 meter unit) and Concentration 3, the stone feature (3 x 3 meter unit). The test unit in Concentration 1 produced a single flake of KRF in Level 1 (0-10 cm) and nine unidentifiable bone fragments with a single fire-cracked rock in Level 3 (20-30 cm).

The large test unit (3 x 3 meters) in Concentration 3 produced fire-cracked rock, numerous flakes of white agate, two flakes of grey porcellanite shatter, and a cutting tool of white agate.

Based upon the provenience of cultural materials in relation to the known bulldozer cut disturbance and the quantity and type of artifacts produced, investigators concluded the site was probably a single component, short-term use, hunting and gathering site of presently unknown age (Borchert et al. 1982).

1.4 REGIONAL CULTURE HISTORY AND LITERATURE REVIEW

The Little Missouri River Badlands lie within a broad cultural region known as the Northwestern Plains. This region includes Wyoming, western South Dakota, western Nebraska,

northern Colorado, northeastern Utah, Eastern Idaho, southern Montana, and southwestern North Dakota. Within this region, distinctive local variants of the broader cultural patterns and developments of the Northwestern Plains have been demonstrated. The Badlands of the Little Missouri River, in a unique environmental position at the edge of the larger Northwestern Plains cultural region and in close proximity to the cultural sphere of the Middle Missouri River cultural area, may eventually prove to be a distinctive sub-area as well (Aivazian 1981).

Although the Badlands area has seen many archaeological investigations recently, no locally specific cultural framework is available presently because a majority of these investigations have been surface inventories for management purposes. The known archaeology of the Grasslands/Badlands is aptly summarized by Loendorf (1978) and Lau (1981), and in the Journal of North Dakota Archaeological Association, Volume 1 (Fox, ed., 1982).

Since no locally specific framework is available, the broader Northwestern Plains culture history must continue to serve as the basis for explaining prehistoric events of the Little Missouri River area.

Mulloy (1958) first developed a cultural framework for the Northwestern Plains. He divided the chronological developments of the region into five periods: Early Prehistoric, Early Middle Prehistoric, Late Middle Prehistoric, Late Prehistoric, and Historic. This scheme was later revised by Frison (1978) to include six periods: the Paleoindian (10,000 to 6,000 B.C.), Early Plains Archaic (6,000 to 2,500 B.C.), Middle Plains Archaic (3,000 to 500 B.C.), Late Plains Archaic (1,600 B.C. to A.D. 700), Late Prehistoric (A.D. 500 to 1,750), and Protohistoric (ca. A.D. 1,750) (see Figure 5). A later Historic period follows.

Paleoindian Period

While a pre-Paleoindian period may exist (see Adovasio et al. 1978; Bonnicksen 1979; and others), the earliest widely accepted cultural complex is the Clovis. Radiocarbon dated as early as 11,200 B.P. at both the Colby site in Wyoming's Big Horn Basin (Frison 1978) and at the Dent site (Figgins 1933; Wormington 1957) in Colorado, the complex is typified by the presence of large lanceolate, fluted projectile points (originally hafted to thrusting spears), associated with megafaunal, usually mammoth remains.

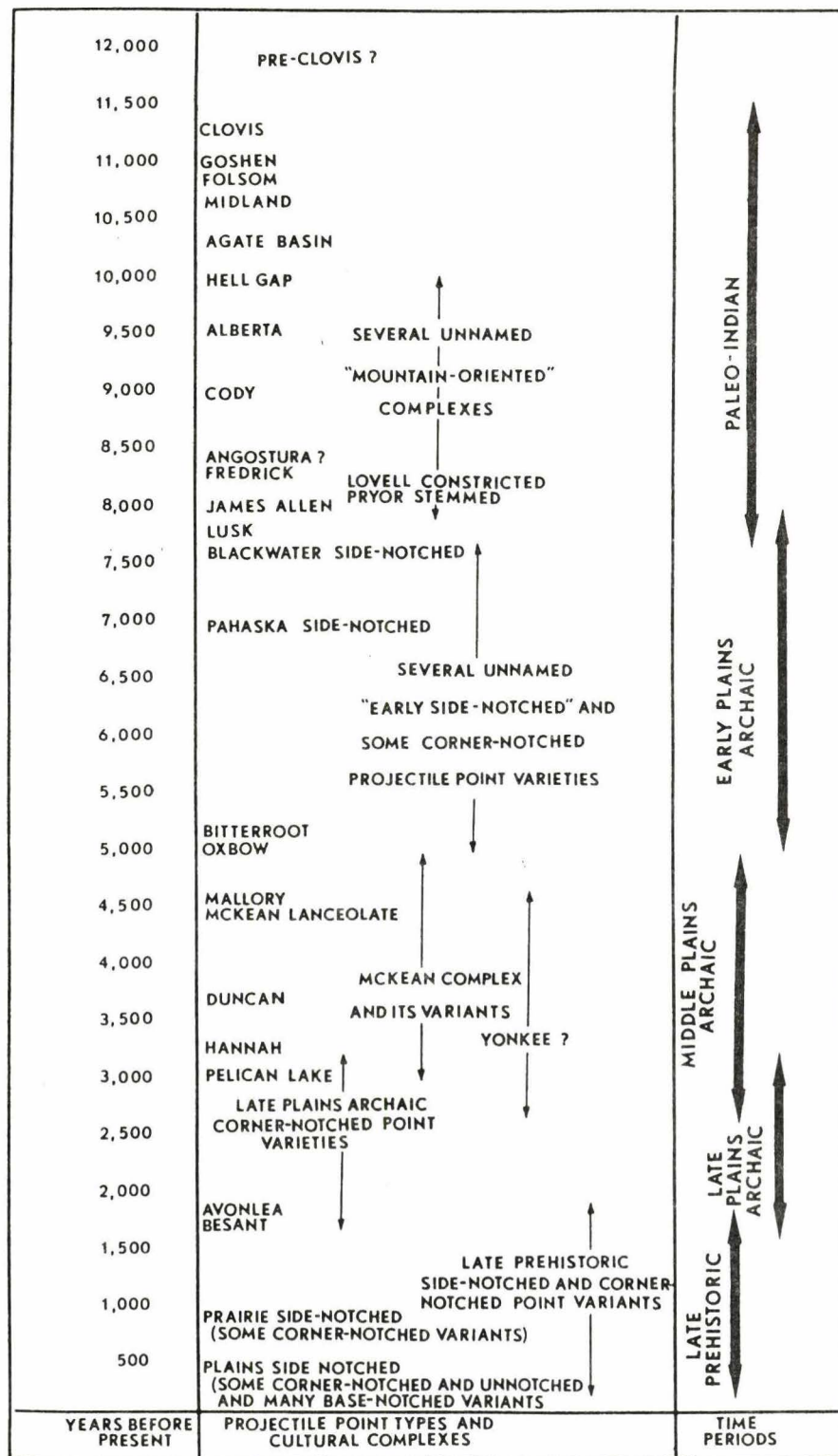


Fig. 5 Northwestern Plains cultural chronology based upon radiocarbon dates and projectile point types (from Frison 1978:83).

Following Clovis is the Folsom complex, associated generally with the kill and processing sites of extinct bison, and characterized also by a lithic technology which featured fluted projectile points. The later Paleoindian period known as Plano includes several well-defined complexes, each with distinctive projectile point styles, whose economies were based on the hunting of modern large game species. The better-defined complexes are Agate Basin, Hell Gap, Alberta, and Cody (Frison 1978; Irwin-Williams et al. 1973; Agenbroad 1978; Jepsen 1953; Wormington 1957). Relevant to our project area, most recently Schneider (1982) compares Plano-period blades from the Moe site in northwestern North Dakota (Schneider 1975) and the Pelland site (Stoltman 1971) in northern Minnesota. Schneider notes that the blades from both sites are of Knife River Flint, a lithic material whose source is west-central North Dakota (Clayton et al. 1970).

Early Plains Archaic

The Early Plains Archaic coincides with the warming, drying trend known as the Altithermal climatic episode. The Mummy Cave excavation (Wedel, Husted and Moss 1968; Husted and Edgar n.d.; McCracken et al. 1978) first demonstrated occupation of the Northern Plains during this period. Nearer the project area, the Myers-Hindman site in Montana (Lahren 1976) produced early side-notched cultural material (Frison 1978).

During this period, large side- and corner-notched projectile points for use with dart and atlatl replaced the earlier lanceolate forms. Bison remained a primary food source on the Plains.

At the end of the period, the Oxbow cultural complex, known first from Saskatchewan (Nero and McCorquodale 1958), and Alberta (Wettlaufer and Mayer-Oakes 1960; Wormington and Forbis 1965) appeared.

Middle Plains Archaic

This period is better known archaeologically than the Early Archaic. The subsistence economy of the Middle Plains Archaic is diverse, with evidence for plant food processing, as seen in an assortment of grinding tools, in addition to the hunting emphasis of the earlier periods. The hallmark of this period is the McKean complex (Mulloy 1954), of which lanceolate projectile points of the McKean, Duncan and Hanna types are known.

McKean sites are often bison traps or jumps whose features include stone circles, drive lines, and cairns. As Roebuck notes (1980), the complex forms the oldest component present at numerous sites from Alberta, e.g., the Head-Smashed-In-Site (Reeves 1974), through Montana, e.g., Pictograph Cave (Mulloy 1952, 1958), and into Wyoming and Colorado, e.g., the McKean site (Mulloy 1954). A Duncan point fragment is listed in the assemblage of artifacts located during the recent survey and testing of the McKenzie County, Cinnamon Creek Ridge project area (East et al. 1981), where sites range from Early Plains Archaic to Late Prehistoric, or at least 3500 B.C. to A.D. 700. The recent investigation of the Cribbage site in Billings County reveals a cultural span from the Middle Plains Archaic to the Late Prehistoric periods (Aivazian 1981).

Late Plains Archaic

The Late Plains Archaic is represented by sites throughout the Northern Plains in a variety of environmental locations which reflect exploitation of a broad range of plant and animal resources. Prominent projectile points of the period are the corner-notched Pelican Lake and Besant types, for which the Mortlach site in south-central Saskatchewan (Wettlaufer 1955) serves as the type site. The later Besant points are associated with a sophisticated bison hunting manifestation (Frison 1978). Dates reported for this complex cluster in the second and third century A.D., but range from ca. 1100 B.P. to ca. 2100 B.P. (see Davis 1982). Of relevance to the present project area is the recent work (Simon and Borchert 1981a) at the Sunday Sage site in nearby Billings County, North Dakota, which indicates an occupational range of Late Plains Archaic to Late Prehistoric periods.

Late Prehistoric Period

The introduction of pottery and the bow and arrow are hallmarks of the Late Prehistoric period. In the case of the latter, this is evidenced by a shift to smaller projectile points and manifested in a variety of types which include side-, basal, and corner-notching.

Of considerable interest on the Northern Plains during this and the antecedent period is a cultural manifestation named for the Avonlea site (Kehoe and McCorquodale 1961) in Saskatchewan and dated to about A.D. 200-800. Known Avonlea

sites are primarily bison drives and jumps and are distributed from southern Saskatchewan and Alberta to the Wyoming-Montana border and east to western South Dakota (Johnson 1970).

While a primary bison hunting economy remained the focus on the western plains during this period, a shift to a horticultural economy occurred to the east along the Missouri trench. This resulted in the evolution of permanent villages and an expanded cultural materials inventory (Lehmer 1971).

Protohistoric Period (ca. 250 B.P.)

The period is known archaeologically for the introduction of trade items such as glass beads and metal objects, along with the development of many small, side-notched projectile point styles and several varieties of pottery. The introduction of the horse and the gun in this period had a profound effect on both the economic and social systems of the Northwest Plains people.

Historic Period

The Historic period, about A.D. 1780 to present, began with the written records of explorers and fur traders in direct contact with various groups such as the Mandan, Hidatsa, Crow, and Dakota (Simon and Borchert 1981). The period is widely associated with the development of large-scale ranching which began in the 1880s, and with the twentieth century homesteading that followed the passage of several acts (1862 Homesteading Act, 1876 Desert Land Act, 1909 Enlarged Homestead Act, and Homestead Act of 1912); see Schlebecker (1975). Ranching and homesteading proved to be largely unsuccessful in the area due to numerous droughts and two national depressions. In the 1930s, the Little Missouri National Grasslands, over a million acres, were set aside for administration by the USFS, Custer National Forest. The lands are generally used by local grazing associations, and the Badlands portion is presently an area of gas and oil development activity.

2.0 RESEARCH DESIGN

The USFS Cultural Resource Management Goals, defined in the Scope of Work, are designed to provide relevant data to enable the eventual evaluation of the two sites' eligibility for the National Register of Historic Places. These goals are threefold:

- a. to define cultural chronology,
- b. to delineate site activity areas, and
- c. to determine site function.

The research goals of this investigation, which are broadly symmetrical with the management goals listed above, were originally defined and disseminated to concerned agencies at the onset of the present field work phase (Tate et al. 1982) and are reiterated herein. Proposed data collection at 32MZ333 and 32MZ334 was geared to interdisciplinary studies for solving, or providing pertinent data for solving, both site specific and regional archaeological problems. Broadly stated, these concerns address the problems of the site depositional history, environmental reconstruction, cultural chronology, site function and activity areas, and technological/economic adaptations.

2.1 SITE DEPOSITIONAL HISTORY

The problem of stratigraphy at 32MZ333 is seen as complex over the site areas. Multiple components of occupation are indicated by the range of time-diagnostic artifacts, such as projectile points (Middle to Late Archaic styles) and ceramics (post-Archaic age). Further, the thickness of deposits, ranging from 20 to 40 cm or more, suggests a long period of occupation, as does the topographic situation of the site atop a ridge crest. Deposits at the site are viewed as having been formed by the actions of human camping, as well as by natural deposition with sediment accumulation occurring over a long period of time. Based upon the range of the time diagnostic artifacts, the period of cultural deposition at the site may extend 6,000 years (5000 B.C. to A.D. 1000).

Previous investigations at the site suggest several periods of deposition and erosion. These episodes have not been defined heretofore in relation to the cultural and natural materials, such as lithic flakes, animal bone (particularly bison), human bone, and fire hearths. Any sequence of occupation/non-occupation that indicates episodic use of the

site would be of particular interest. If the sites are multicomponent, site stratigraphy revealed in shovel probes, test pits, quadrants, and cutbank profiles would reveal any layered deposits, which would then be investigated for diagnostic artifact types, associated tool assemblages, and ecofactual specimens. Particular attention was directed to the nature of any layered deposits (soil texture, structure, and color), as well as to contacts (abrupt, diffused, gradational, buried soils), as these bear on depositional history.

2.2 ENVIRONMENTAL RECONSTRUCTION

We proposed the reconstruction of the depositional environments which led to the formation of the various layered deposits and the contacts between these layers to provide a first approximation of the ancient environments of human occupation. Further amplification of these past environments would be made based on studies of the various ecofactual remains located in each sedimentary layer. Examples of these lines of ecofactual evidence are pollen, macroplant parts, animal bone, land snails, and phytoliths. Studies of these various kinds of environmental evidence were planned to assist in the reconstruction of the natural surroundings of the sites and to serve in the delineation of some of the available useful plant and animal resources of the past. Further research problems concerned the nature of environmental change over time and the kinds of shifting human adaptive responses.

2.3 CULTURAL CHRONOLOGY

Little is known of the cultural chronology of this portion of southwestern North Dakota. Questions in this regard include: Do these sites represent short term seasonal occupation or long term habitations? Were they occupied continuously or episodically?

The problem of chronology building was to be probed in two fashions: first, by studying each site's stratigraphy to allow construction of a relative chronology of intervals of on-site cultural deposition interrupted by gaps of non-deposition; next, by construction of a relative chronology through the stylistic dating of each time diagnostic projectile point and potsherd recovered, by associated depositional layer, and fire hearth feature. This absolute dating was to be confirmed by radiocarbon dating of the fire hearths and obsidian hydration study of appropriate

lithic artifacts. Our goal was to collect temporal information from the top and bottom of each layer in order to determine the rates of sedimentation and lengths of non-depositional episodes.

2.4 SITE FUNCTION AND ACTIVITY AREAS

The various behavioral activities which occurred at the site during each time period were to be identified by interpreting the tool assemblage and useful resources from each site. Were basic activities of extraction and maintenance conducted throughout the site during all seasons of the year? Or were such generalized food and material processing activities conducted during specific seasons of the year and/or at particular locations within the site perimeter? In order to determine specific activity locations by time period, we proposed to plot the concentration index (specimen count per unit volume of sediment) for each artifact and ecofact class over the excavated site area. From such density maps, "hot spots" of human activity would be examined to determine if the site layout is homogeneous or heterogeneous as to the range of human actions. In particular, the density range of tools and useful natural resources found clustered around fire hearths would assist in determining whether the sites were occupied on an episodic basis or more continuously on an annual basis.

2.5 TECHNOLOGICAL/ECONOMIC ADAPTATIONS

The range of technical activities conducted at the two sites was investigated by study of each artifact class (lithic, ceramics) for material type and source (e.g., Knife River Flint), for methods of manufacture, function, and area of discard. We proposed to map the distribution of different artifact types to provide a statement of tool associations and how these subassemblages reflected tool kits for processing materials and energy and whether these technological assemblages were correlated with activities, resources, or temporal periods. The study of technical activities might help to explain the availability of and/or preference for lithic raw material over time and the role of local versus imported materials.

Further, economic and social organization of the local community might also be revealed in the patterning of tool and/or feature clusters defined by density mapping, e.g. hearth clusters might be reflective of socioeconomic groups and the

manner in which these groups were organized into the larger community. Finally, comparison of the site data with other sites in the Northern Plains region may help place the site in a regional perspective.

3.0 GENERAL PROJECT METHODOLOGY

The project methodology included a testing program which consisted of both systematic shovel probing and excavation by formal units at each site with subsequent analyses of resulting data by archaeologists and appropriate interdisciplinary specialists.

3.1 FIELD PROCEDURES

The proposed test excavation strategy for the Abraxas project, as outlined in the Scope of Work proposal (USDA Forest Service 1982), utilized techniques found to be effective in other areas of the Little Missouri Grasslands during previous testing and mitigation programs. The testing was formally designed to include the use of systematic subsurface shovel probes in conjunction with formalized 1 x 1 meter test units at both 32MZ333 and 32MZ334. In addition, two 4 x 4 meter test units were to be excavated adjacent to UNDAR-West's previous productive test units at 32MZ333. As well, a four-meter section of the eroding cutbank surface was to be profiled and excavated back 50 centimeters for examination by a qualified professional geomorphologist. The testing was to be of a nature sufficient to provide relevant data to the USFS cultural resource management goals of evaluation of the sites' eligibility for inclusion in the National Register of Historic Places.

3.1.1 Shovel Probes and 1 x 1 Meter Test Pits

The initial testing phase at each site consisted of the excavation of a series of systematic shovel probes across the site area adjacent to the previous road construction. A series of three parallel transects with probes placed at five to eight meter intervals was specified in the Scope of Work. The first two transects were placed immediately adjacent to the initial impact corridor on each side of the road at both 32MZ333 and 32MZ334. The third transect at 32MZ334 was then placed parallel to the first transect along the north side of the road at 10 meters and offset between the first transect of probes. This third transect was so placed because of the major impact of proposed road construction along the northern edge of the site area. At 32MZ333, the third transect of probes was held in reserve and probes were subsequently placed along both sides of the road five meters from the first transects and offset between the first series of probes in areas of high

site potential and areas adjacent to previously productive probes.

The individual probes within each transect were placed at five-meter intervals at each site. The exact placement of the shovel probes and transects was delineated by pacing. Areas of obvious erosion and deflation were avoided during the initial probing. Areas deflated to sterile bedrock surfaces were skipped over or the probes were placed in adjacent, intact areas which accounts for the gaps and irregular placement of the probes in certain areas of the transects (see Maps 1-4).

A total of 231 probes were excavated at 32MZ333 and a total of 78 at 32MZ334. Each probe was hand excavated using a shovel rather than a power auger. The probes were approximately 10 to 12 inches in diameter and each was excavated to sterile subsoil. Some of the deeper probes were slightly larger in diameter. The soil from each probe was screened using a quarter-inch mesh hardware cloth to check for cultural materials. When cultural materials were found, they were bagged and labeled according to transect number and probe number. At 32MZ333, Transect 1 was placed south of the road, Transect 2 north of the road. The probes were excavated east-to-west and numbered consecutively. The third transect was then placed west-to-east over the site, numbered consecutively from the adjacent probe transect. At 32MZ334, Transect 1 was placed south of the road and Transect 2 north. The third transect was placed entirely north of Transect 2 and labeled consecutively north-south as a separate transect.

The shovel probes were then measured to record the visible stratigraphy present, total depth and content. Each transect of probes was then mapped using a transit and metric stadia rod from the established site datum. The probes were then backfilled.

The initial shovel probe testing was then augmented by the excavation of a series of formal 1 x 1 meter test squares over productive test probes. The Scope of Work specified a maximum of 10 such units at 32MZ333 and eight units at 32MZ334.

The location of the excavation units was controlled by means of a metric grid superimposed over each site. The grid was oriented true north and each unit numbered by its relationship

to the site datum, designated ON OW. The reference designation for any given unit consists of the coordinates of its control point, the southwestern corner of the unit (Figure 6).

At 32MZ334, a total of five shovel probes produced cultural materials. Formal 1 x 1 meter squares were subsequently opened on each of these probes. Also, one square was excavated adjacent to an in situ quartzite cobble exposed during the construction north of the road. In addition, after consultation with USFS archaeologists, two additional units were excavated at 32MZ334.

At 32MZ333, all ten formal 1 x 1 meter units were also subsequently excavated over the most productive test probes over the central site area. Probes were selected for formal testing based upon the amounts of cultural material recovered from the probe and from the position of the probe in order to investigate all areas of the main site producing materials. Several of these units were subsequently expanded into larger blocks after consultation with USFS archaeologists.

All formal 1 x 1 meter units were excavated using a shovel and trowel. The matrix was screened using quarter-inch hardware cloth as per Scope of Work specifications. A constant volume of matrix (about 10 percent) was retained from all levels of each 1 x 1 unit for subsequent wet screening at each site.

The excavated shovel probes were used to estimate the stratigraphy present for each excavated square. Natural stratigraphic units of varying depth were used wherever possible. In areas where no visible stratigraphy was present or where natural units were extremely thick, arbitrary 10 centimeter provenience levels were used.

Palynological and soil compositional samples were obtained from each site from a stratigraphic column. All feature fill was retained for subsequent flotational analysis. Radiocarbon samples were retained wherever possible as were all artifacts and bone samples.

3.1.2 4 x 4 Meter Excavation Units

As specified in the Scope of Work, two 4 x 4 meter units were excavated at 32MZ333, one on each side of the present road corridor in areas adjacent to the UNDAR-West productive test units. The placement of these units was identified by

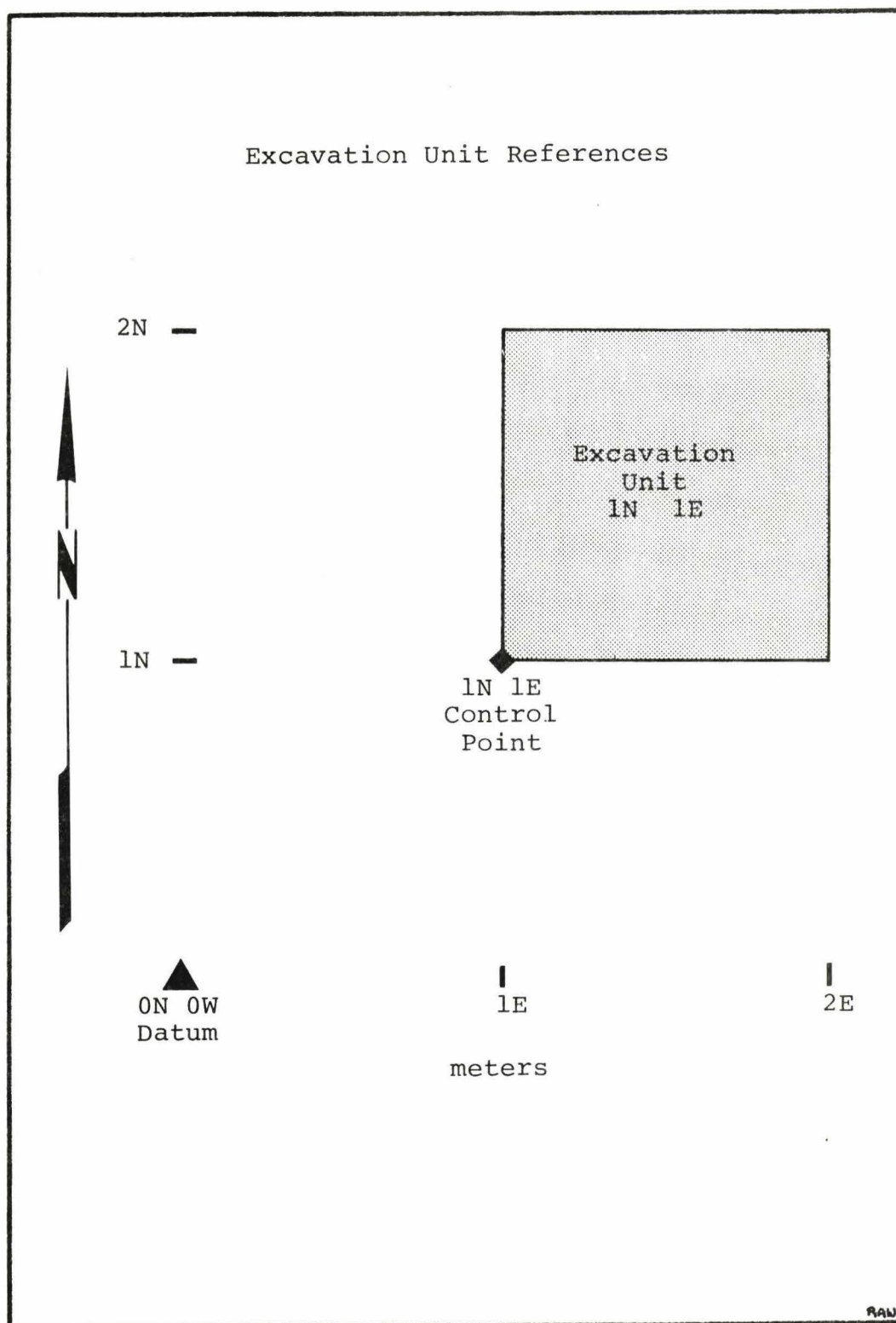


Figure 6

the results of the 1 x 1 meter testing over the productive shovel probes after consultation with USFS archaeologists. The lateral limits of the 4 x 4 units were determined by following artifact and feature concentrations encountered during excavation. These units were excavated to sterile subsoil following the same methodology outlined above.

3.1.3 Profile Cuts

The Scope of Work outline provided by the USFS specified that a four-meter section of the cutbank south of the present road corridor at 32MZ333 be hand faced, mapped in profile, and excavated back at least 50 centimeters. After consultation with the USFS archaeologist, it was decided to excavate two two-meter sections of the cutface to examine different areas of the profile rather than one large profile unit. The placement of these units was determined by examination of the cutbank surfaces for areas of eroding cultural materials and bone fragments. The two-meter sections were gridded, hand faced and excavated by the same methods as outlined above. The cutbank profile, as well as those of the other excavated units, was carefully examined by Dr. John Albanese, a qualified geomorphologist, to determine the depositional/erosional history of the site.

3.2 LABORATORY PROCEDURES

Laboratory procedures used for the analysis of the materials from the Abraxas project were simple and straightforward, with the goals of processing the data for cleaning, sorting, and final packaging of the retrieved materials. Samples of soil, carbon, pollen, bone, and obsidian were sorted and labeled. These samples were then sent to the appropriate consultants for analysis.

All soil samples collected for waterscreening were separated and processed through a waterscreen device using 16-to-the-inch mesh. The resultant flotation samples were labeled and packaged separately by site and provenience. They were then sorted using a hand magnifying glass and tweezers to retrieve all cultural materials, such as microflakes and bone.

All retrieved artifacts were washed under running water to remove dirt, then sorted and analyzed. Those exhibiting a buildup of calcium carbonate which would act to obscure further analysis were cleaned using a dilute solution of 15 percent hydrochloric acid. The materials were then

replaced in their respective labeled containers for initial rough sort and continued analysis.

3.2.1 Lithic Artifact Analysis

The artifacts (all lithics) were initially sorted by excavation unit and level into generalized tool and debitage classes. These classes were defined to include terms and categories of general use in the site descriptions of the Northern Plains.

Patterned Tools

Projectile Points

Projectile points are artifacts designed for hafting and propulsion at the missile end of the projectile shaft: either a spear, dart or arrow (McCormack and Irwin-Williams n.d.). It is also recognized that these tools may have served a variety of secondary functions of cutting, scraping, perforating, etc. (Greiser 1977; Ahler 1970).

The following measurements were taken for projectile points: total length, maximum width, blade edge length, stem length, base width, neck width, notch width, notch depth, shoulder width (all measurements taken in millimeters). Weight was also noted to the nearest 0.1 gram. These same measurements or all applicable elements present were taken for all bifacial implements present.

Knives

Knives are bifacially worked tools designed to operate as cutting edges. This implies a motion parallel to the worked edge with wear characterized by edge rounding and dulling, feather or hinged microspalling, striations and/or polish on one or both sides (McCormack and Irwin-Williams n.d.; Greiser 1977; Ahler 1970).

Blanks

A blank is any piece of lithic material that has been modified to an intermediate stage of lithic reduction sequence in a specified assemblage. The piece must be unfinished with further modification intended. It must also be potentially modifiable into more than one type of finished tool (Bradley 1975).

Preforms

Preforms are raw material pieces modified to an intermediate stage of a lithic reduction sequence in a specified assemblage. The piece must be unfinished and intended for further modification and must have the morphological potential to be modified into a single implement type in the assemblage (Bradley 1975).

Bifaces

Bifaces are relatively thin, worked items which have been modified on both dorsal and ventral surfaces. The flake removal scars may partially or completely cover both surfaces. This is a broad category covering a wide range of cultural materials having several different functions. The artifacts are not complete enough to allow absolute identification of the intended implement. This category is subdivided into biface tips, midsections, bases, and lateral edge fragments.

Drills

Drills are bifacially modified, elongated projections which are assumed to have been used in a rotary motion. Wear patterns are generally represented by dulling, rounding, and striations perpendicular to the long axis of the tool (McCormack and Irwin-Williams n.d.; Tringham et al. 1974).

Endscrapers

Endscrapers are flakes exhibiting secondary retouch on the distal edge opposite the platform and bulb. The long axis of the retouched distal edge is 90° to the long axis of the flake. The maximum width of the retouched distal edge is equal to or less than the maximum length of the flake (Honea 1965). Measurements taken for tools of this class were length, width, thickness, weight, and length of retouched edge.

End-side Scrapers

End-side scrapers are flakes exhibiting secondary retouch on the distal edge opposite the platform and on one or both lateral edges. The long axis of the retouched distal edge is 90° while the long axis of the lateral retouched edge is parallel and at an angle less than 45° to the flake's long

axis (Honea 1965). Measurements taken for tools of this class were length, width, thickness, weight, and length of retouched edge.

Cores

Cores are masses of material often pre-formed by the worker to allow the removal of a desired flake (Crabtree 1972). Any piece of raw material that has had flakes struck from it, the desired product being the flake, is considered a core (Bradley 1975). Measurements taken for artifacts of this type were length, width, thickness, and weight.

Unpatterned Tools

Modified/Retouched Flakes

Modified/retouched flakes are flakes of lithic material which retain many of their original characteristics and features but have been intentionally retouched or modified along a portion or portions of one or more edges after initial detachment from the core (McCormack and Irwin-Williams n.d.). This class can be subdivided into two categories: those flakes which exhibit bifacial modification (on both dorsal and ventral surfaces), and those which exhibit unifacial modification (on either the dorsal or ventral surface). Measurements taken for this tool class were length, width, thickness, and weight.

Utilized Flakes

Utilized flakes are flakes of lithic material which retain many of their original characteristics and features but show evidence of having been utilized along a portion of one or more edges without prior retouch or deliberate modification (McCormack and Irwin-Williams n.d.). Measurements taken were length, width, thickness, and weight. A Kyowa microscope with 10-30X magnification was used to determine utilization.

Debitage

Debitage is residual lithic material resulting from tool manufacture. Debitage flakes usually represent the various stages of progress of the raw material from the original form to the finished product (Crabtree 1972). The basic unit of lithic analysis is the waste flake. Its distribution

over a site is ultimately the function of the energy used to detach the flake from its core. Its size is the function of the energy delivered to each blow, the angle of the blow, and the resilience of the hammer (Neumann and Johnson 1979).

All debitage from the site was analyzed by a standard series of procedures specifically defined below.

Raw Material

The first step was the sorting of the waste debitage into groups based upon the raw materials present. The raw materials are discussed later.

Size

As a means of standard control and quantification of the amount and volume of the waste flakes present, the debitage was sorted into standard size groups for each raw material present. Size was an important determining factor in several major replication studies (Henry, Haynes and Bradley 1976; Patterson and Sollberger 1978) and is a useful attribute in the determination of lithic reduction stages. Complete lithic reductions to produce bifaces give flake distributions skewed toward higher percentages of small flakes (Patterson and Sollberger 1978). However, recovery of flakes on archaeological sites does not always give the same proportions of flake sizes as were originally produced (Patterson and Sollberger 1978).

Weights

Using an Ohaus balance which is accurate to the nearest 0.1 gram, flakes were then weighed by each flake size and raw material category. This was done as an added measure of quantification for each size group and for raw materials as a whole.

Flake Subcategories

The flakes were then subdivided into flake subcategories based on reduction stage and a measure of the remnant cortex. The flake categories are defined below.

Primary Flakes. The first flakes removed from a nodule. The flakes have cortex completely covering the dorsal surface (Schneider 1972).

Secondary Flakes. Removed after the initial modification of the parent source, secondary flakes exhibit cortex covering part of the dorsal surface area (Schneider 1972).

Tertiary Flakes. Flakes which exhibit no cortex on the dorsal surface or striking platform. The cortex has been either trimmed off or the flake was struck after the cortex was completely removed from the core (Schneider 1972).

Primary and secondary flakes are usually associated with the early stages of lithic reduction and tertiary flakes with the latter stages.

Thinning Flakes. Flakes removed from a preform, biface, or uniface to thin the piece to desired form, usually exhibiting a special platform preparation (Crabtree 1972). These flakes tell more of the manufacturing process than any other flake in early stages of manufacture and exhibit all of the following: platform preparation, direction of force, angle of force, previous flake scars, type of fabricator used (Muto 1971).

Mode of Manufacture

An attempt was then made to determine the method of manufacture of the flakes for those flakes exhibiting a remnant platform/proximal end of the flake. No attempt was made to identify those flakes without platforms present. Three modes of manufacture were recognized and defined below: hard hammer percussion, soft hammer percussion, and direct pressure.

Hard Hammer Percussion

Identifying characteristics of hard hammer percussion are: salient bulb of percussion, acuminate bulb of percussion relative to contact area, moderate to heavy crushing of platform area, collapse of platform, salient ripple marks, fissures, and erailures (Crabtree 1972; Muto 1971).

Soft Hammer Percussion

Identifying characteristics of soft hammer percussion are: diffuse bulb of percussion, truncated bulb relative to

contact area and softness of percussion, lip on proximal end of ventral surface, erailures, ripples, and fissures (Crabtree 1972; Muto 1971).

Direct Pressure

Flakes produced by direct pressure are generally smaller and thinner than those produced by direct percussion. However, pressure flakes may exceed two inches in length (Crabtree 1972) or 18 mm (Patterson and Sollberger 1978). The last stage of pressure flaking detaches many small flakes which have a tendency to collapse (Crabtree 1972). Pressure flakes have a tendency to preserve a high percentage of residual platforms (Patterson and Sollberger 1978).

However, the methods of production are largely speculative. As pointed out by Patterson and Sollberger (1978), lipped flakes are not truly a reliable indicator of billet flaking. While it may be possible to identify the method of force when only one technique is used, a mixture of techniques is difficult to identify because almost identical flakes are produced by all three modes of production. Henry, Haynes and Bradley (1976) were also unable to quantify the differences based on size, weight and thickness.

Utilization

The 10X power microscope provided little in the way of usable or identifiable utilization/wear analysis and only general comments can be offered. The characteristic of edge damage on utilized flakes is discussed in numerous sources, e.g., Tringham et al. (1974), Odell and Odell (1980), and numerous authors in Hayden (1979). Edge damage/use wear on stone tools has been discussed by Ahler (1970), Greiser (1977), and Ahler and various authors in Hayden (1979).

Raw Materials

Knife River Flint (KRF)

Knife River Flint is a fairly uniform, nonporous, dark brown flint caused by the silicification of lignite. It exhibits mottled or laminated internal structure from the original lignite. The source of the material is probably the Eocene Golden Valley formation. The material occurs in gravel deposits throughout Mercer and Dunn Counties, North Dakota,

and in secondary lag deposits in and around the Little Missouri Badlands (Clayton et al. 1970).

Chalcedony

Chalcedony is a variety of cryptocrystalline quartz. It is here defined as light in color (clear to white), without numerous foreign inclusions or color banding. Chalcedony is translucent to subtranslucent, with a waxy luster. Ahler (1977) notes that most of the material referred to as chalcedony is actually petrified wood which shows the remnant wood grain only when weathered, patinated, or heat altered. This silicified wood is common in the Paleocene Sentinel Butte formation.

Porcellanite

Porcellanite is a metamorphosed shale that is the product of the burning of underground lignite deposits. Two varieties are common, one red in color and very vitreous; the other grey and generally non-vitreous (although the range of porcellanite observed has been from very coarse and non-vitreous to a very fine grained vitreous texture). Grey porcellanite is generally more readily available and superior in flaking quality (Fredlund 1976). The source is the Fort Union group with the Sentinel Butte formation as the upper member (Clayton et al. 1970).

Cherts

Cherts are a variety of cryptocrystalline quartz. As defined here, cherts are opaque to very weakly translucent with a dull to waxy luster. The colors are variable, with grey and white in the current assemblage. Discussion of the origins of various cherts is impossible without detailed analyses and thin sections. Cherts have, however, been observed in various layers and deposits within the Little Missouri Badlands.

Petrified Wood

Petrified wood is wood that has been replaced by some form of cryptocrystalline quartz. Usually at least part of the wood grain texture is visible. Petrified wood is common in the Little Missouri Badlands, particularly in exposed layers of the Sentinel Butte formation (Bluemle 1972). Much of the wood is unusable for tool manufacture, but deposits of usable woods do exist.

Tongue River Silicified Sediment (TRSS)

Tongue River Silicified Sediment is composed of fine-to-medium grained sand cemented by silica. Tongue River Silicified Sediment is often confused with quartzite or pseudoquartzite. It is distinguished by the presence of hollow fossil plant roots. The smooth grey variety is opaque and mottled, has a dull luster, and is fine grained. Its origin is the contact between the Paleocene, Slope, and Bullion Creek formations in southwest North Dakota (Ahler 1977).

Agate

Agate is a variegated cryptocrystalline quartz with a waxy luster. The colors are usually distinct and appear in banded layers or clouds. The exact origins are unclear but agates are present in observed gravels in the areas of the Little Missouri River Badlands.

Obsidian

Obsidian is a volcanic glass of low water content. Obsidian is not locally available and is, therefore, considered exotic. All obsidian resulting from the current project is from the Obsidian Cliff source in Yellowstone National Park (Michels, Appendix 7.2).

3.2.2 Special Consultant Analyses

After termination of field work, samples were conveyed to our consultants for specialized analyses. Linda Scott of Palynological Analysts, Montrose, CO, performed pollen analysis, flotation and macrofloral analysis on samples from most features and every stratigraphic level. The bone specimens were analyzed for species identification, size, weight, and any evidence of human utilization by Stephen Chomko, Paleo-Environmental Consultants, Denver, CO. The single potsherd recovered by this investigation, along with the sherds recovered by UNDAR-West, were described and typed by Dr. Ann M. Johnson, consulting archaeologist, Denver, CO. Dr. Joseph W. Michels of MOHLAB, State College, PA, analyzed the four obsidian flake specimens for source identification and dating. Charcoal, feature fill, and soil matrix samples were sent to Drs. Jerry Stipp and Murry Tamers of Beta Analytic, Inc., of Coral Gables, FL, for radiocarbon dating, which required extensive pretreatment

and special handling in several cases. A geomorphological investigation was conducted at Site 32MZ333 by John P. Albanese, consulting geologist, Casper, WY.

These reports are attached as Appendices 7.1 through 7.6.

4.0 OPERATIONS AND RESULTS

The application of the methodology described above resulted in the recovery of a considerable quantity of cultural material and features. These will be detailed below by site and excavation unit.

4.1 SITE 32MZ333

To meet the needs of the Scope of Work and research design, several types and configurations of excavation were conducted at this site. Based on the results of the Shovel Probe phase, seven individual 1 x 1 m units were placed in the central portion of the site, along with a 2 x 2 m block and a T-square shaped block of four 1 x 1 m units. These are described in the first section below. Subsequent sections describe the 4 x 4 m block north of the road, the 4 x 4 m block south of the road, and the two profile cut excavations. The 2 x 2 m block is discussed with the 4 x 4 m block south of the road since the 2 x 2 m unit revealed a feature similar to the contents of the larger block. The T-square block is treated with the discussion of the 1 x 1 m units.

4.1.1 Shovel Probes

A total of 231 shovel probes were placed across the lateral east-west limits of Site 32MZ333 during the initial investigation phase. The exact placement and numbering of these probes are provided in Maps 1, 2, and 3. Twenty-three or 10 percent of the probes produced cultural materials when screened through quarter-inch mesh hardware cloth. Of the 23 productive probes, 18 (78.3 percent) were located within the central site area; two (8.7 percent) were located within the eastern site area; and three (13.0 percent) were located in the western site area (Table 1).

The results of the shovel probe phase of the investigation revealed that the remnant areas of potentially significant cultural materials were restricted to the central site area. Although cultural materials were originally described as covering the entire width of the site, no significant materials were recovered by the probes in the eastern and western portions. After consultation with USFS archaeologists, all further investigation was restricted to the central site area of high potential for significant cultural deposits. No further work was undertaken in the eastern or western portions of the site (see Maps 2 and 3).

Table 1

Summary of Productive Probes at 32MZ333

<u>Transect</u>	<u>Probe</u>	<u>Total Depth (cm)</u>	<u>Soil Depth (cm)</u>	<u>Comments Associations</u>	<u>Cultural Materials</u>
1 (south of road)	53	36	36	0-4 sod 4-8 lt. tan sandy loam 8-25 dk. brn. paleosol 25-36 mottled lt. & dk. brn. 36+ tan sandy clay	1 KRF tertiary flake
1	55	48	48	same as above paleosol 10-22	1 chalcedony secondary flake 1 obsidian tertiary flake
1	57	39	39	same - paleosol 10-21	1 KRF tertiary flake
1	58	37	37	same - paleosol 10-24	1 KRF tertiary flake
1	61	23	23	same - paleosol 12-23	1 KRF tertiary flake
1	66	43	43	same - paleosol 11-29	1 grey porcellanite tertiary flake 1 KRF point midsection 1 KRF angular debris
1	82	57	57	0-6 sod 6-12 lt. brn. sandy loam 12-57 brn. sandy loam 57+ tan clay	1 unidentifiable bone fragment
1	101	40	40	same as above	1 unidentifiable tooth fragment
1	108	34	34	0-5 sod 5-8 lt. brn. loam 8-34 dk. brn. sandy loam 34+ tan sandy clay	1 KRF tertiary flake
1	109	40	40	0-4 sod 4-12 lt. brn. sandy loam 12-40 dk. brn. loam 40+ tan clay	1 KRF tertiary flake 2 porcellanite tertiary flakes 2 quartzite fragments

Table 1 (continued)

<u>Transect</u>	<u>Probe</u>	<u>Total Depth (cm)</u>	<u>Soil Depth (cm)</u>	<u>Comments Associations</u>	<u>Cultural Materials</u>
1	111	38	38	Same as above	1 quartzite fragment
2	30	31	31	lt. brn. & dk. brn. sandy loams to tan clay	1 KRF tertiary flake
2	48	48	46	0-8 sod 8-14 lt. brn. sandy loam 14-22 dk. brn. loam paleosol 22-42 lt. brn. loam 46-48+ tan clay	1 KRF tertiary flake
2	50	36	13	0-6 sod 6-13 lt. brn. loam 13-18 dk. grey clay 18-36+ tan clay	1 KRF tertiary flake 2 chalcedony tertiary flakes
2	51	44	25	0-6 sod 6-25 lt. brn. loam 25-35 tan clay 35-44+ dk. grey clay	1 red quartzite angular fragment
2	53	43	20	0-6 sod 6-20 brn. sandy loam 20-34 lt. brn. sandy loam	2 KRF tertiary flakes
2	66	58	58	0-33 dk. brn. sandy loam 33-53 lt. brn. sandy loam 53-58 tan sandy loam	1 KRF utilized tertiary flake
2	89	38	27	lt. brn. sandy loams to tan sandy clay	1 KRF tertiary flake
2	92	47	13.5	0-13.5 dk. brn. sandy loam, charcoal flecks & cultural material 13.5-47 lt. tan sandy silts	12 KRF flakes 1 grey porcellanite flake 1 bone fragment

Table 1 (continued)

<u>Transect</u>	<u>Probe</u>	<u>Total Depth (cm)</u>	<u>Soil Depth (cm)</u>	<u>Comments Associations</u>	<u>Cultural Materials</u>
2	93	31	16	same as above, 0-16 dk. loam	2 KRF tertiary flakes
2	95	50	13	brn. loams to 13 cm, tan sandy clays to clay	4 grey porcellanite flakes
2	96	45	21	same as above	1 KRF tertiary flake 1 tertiary grey porcellanite flake
2	111	36	30	0-4 sod 4-10 lt. brn. loam 10-30 dk. brn. loam 30-36+ tan clay	1 KRF tertiary flake

4.1.2 1 x 1 Meter Units

Eleven 1 x 1 m units were excavated over productive probes indicative of further potential for significant cultural materials. These units were excavated to sterile subsoil using arbitrary 10 cm levels or natural cultural stratigraphy, as appropriate.

Four of the 1 x 1 m test units were eventually expanded into larger block units after consultation with USFS archaeologists. These four 1 x 1 m units were 11N 60W over Probe 66, Transect 1; 35S 5W over Probe 109, Transect 1; 29S 5W over Probe 57, Transect 1; and 2S 2W over Probe 92, Transect 2. These are discussed in detail in the following subsections.

The remaining seven 1 x 1 m units were placed over productive probes but failed to produce evidence of significant cultural deposits, and no further excavations were conducted around these test units. These units, which are described below, were placed over productive probes in order to test all areas of the site for potential deposits. Only one unit was not placed on a productive probe; Unit 9N 1W was placed north of the four-meter block 0N-3S 1E-3W to ascertain the northern limit of cultural materials.

Unit 47S 11E

This unit was placed over Probe 53, Transect 1, and was excavated by removing the sod, 0-5 cm, and using arbitrary 10 cm levels to 45 cm.

Level 4 produced a single humerus (left distal) of Bison bison. No cultural materials were encountered. The bone was recovered in a vertical position in what appeared to be a large disturbance area, a probable rodent burrow. As such, the exact vertical provenience and relationship of the bone to the site are questionable.

Unit 38S 3E

This unit was placed over Probe 55, Transect 1, and was excavated by arbitrary 10 cm levels to 30 cm. Level 1 produced the only cultural materials encountered, two flakes, described on the following page:

<u>Material</u>	<u>Size (mm)</u>	<u>#</u>	<u>Wt(g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
KRF	5-10	1	0.2	tertiary	unknown
KRF	20-25	1	2.2	thinning	soft hammer

Unit 25S 7W

This unit was placed adjacent to UNDAR-West test squares from 1981 and in the vicinity of Probe 58, Transect 1. It was excavated using natural stratigraphic levels: a recent upper zone of light brown sandy loam, and a dark brown paleosol, each 10-12 cm thick; followed by a tan sandy clay, excavated to 45 cm. All cultural materials recovered, four flakes, were from Level 3.

<u>Material</u>	<u>Size (mm)</u>	<u>#</u>	<u>Wt (g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
KRF	5-10	1	0.3	tertiary	unknown
KRF	15-20	1	0.3	tertiary	unknown
KRF	30-35	1	6.0	tertiary	hard hammer
TRSS	5-10	1	0.2	tertiary	unknown

Unit 11S 21W

This unit was placed in the vicinity of Probe 61, Transect 1, and was excavated in arbitrary 10 cm levels. Three artifacts, described below, were recovered in Levels 1 and 2.

<u>Material</u>	<u>Size (mm)</u>	<u>#</u>	<u>Wt (g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
Level 1					
Grey por-cellanite	15-20	1	0.7	tertiary	unknown
Level 2					
Grey por-cellanite	10-15	2	0.3	1 secondary	unknown
				1 tertiary	unknown

Unit 11S 0W

The unit was excavated over Probe 51, Transect 2, using natural stratigraphy. All cultural materials, three flakes, were located in Level 1, 0-13.5 cm.

<u>Material</u>	<u>Size (mm)</u>	<u>#</u>	<u>Wt (g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
KRF	10-15	3	0.6	2 tertiary 1 tertiary	soft hammer unknown

Unit 15S 11E

This unit was placed over Probe 95, Transect 2. Excavation, by arbitrary 10 cm levels, produced two pieces of cracked granite totalling 276.7 g from Level 2 (10-20 cm). No cultural materials were recovered.

Unit 9N 0W

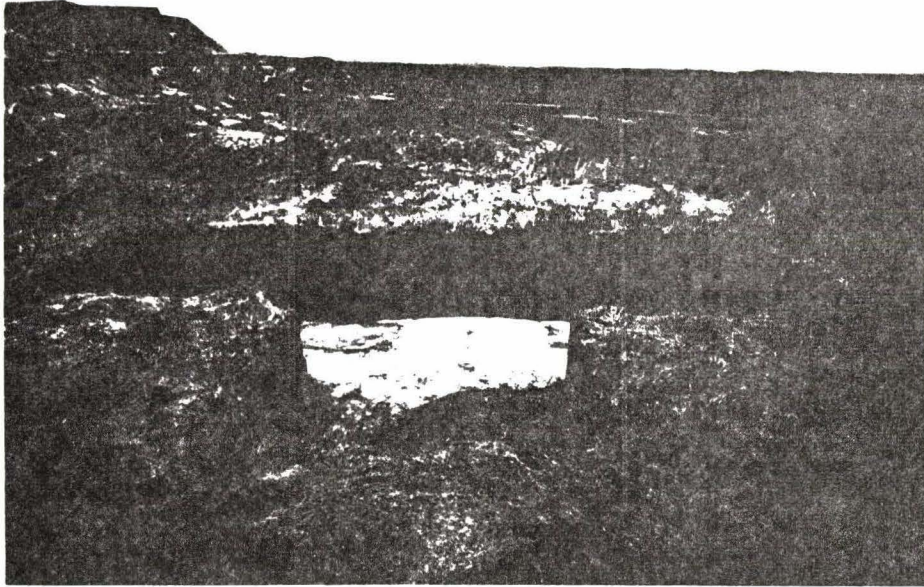
This unit was placed north of the 4 x 4 meter unit 0N 3S 1E 3W to define the north limits of cultural material. The top seven cm of sod were removed as a level and the 7-10 cm of the remaining dark sandy loam paleosol were removed as a level. The remaining 45 cm were excavated in arbitrary 10 cm levels. Two flakes were recovered from Level 2 (base of 7-10 cm paleosol); no other materials were recovered. The flakes are described below:

<u>Material</u>	<u>Size (mm)</u>	<u>#</u>	<u>Wt (g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
KRF	10-15	2	0.5	1 tertiary 1 tertiary	direct pressure soft hammer

Units 11-12N 59-61W

A block excavation consisting of four 1 x 1 meter units was placed on a small, eroded point northwest of the site datum and south of the existing road (Plate 2). The placement of this unit was determined by the initial shovel probing phase. Shovel Probe 66 of Transect 1 produced one large angular debris fragment of KRF (45-60 mm) weighing 21.1 g and one projectile point midsection of KRF. Subsequently, a formal 1 x 1 meter excavation unit, 11N 60W, placed over this probe, produced 11 additional waste flakes. Since this area of the site was isolated from the rest of the site and heavily eroded, three additional 1 x 1 meter units were excavated in a T-shaped pattern. The units excavated were 11N 59W, 11N 60W, 11N 61W, and 12N 60W (see Map 1).

Plate 2



32MZ333 Four meter area on point facing south

Stratigraphy

The initial shovel probe and the eroding cutface exposures on the small point revealed a relatively simple stratigraphic profile. The modern sod zone consisted of a dark brown, sandy loam five to six cm deep. Underlying this layer was the light brown loam of eolian origin of the upper, recent soil zone. This unit extended about five to 10 or 12 cm in depth, variable over the area excavated. The soil was shallower on the west, increasing in depth to the east, and thinner to the north where erosion eventually exposed sterile clays (Figure 7, Profile). The dark, lower paleosol was then present and extended to variable depths over the point, ranging from about 10-25 cm. The paleosol became thinner northward, eroding away to sterile clays, as shown in profile. Beneath this zone was a tan, sandy clay. The stratigraphy is the same as in the profile excavations except that no incipient soil layers were present in the upper recent soil zone.

Excavation Methodology

Arbitrary 10 cm levels were used in the excavation of the units within this block. The units were excavated to 40 cm BGS, well below the dark paleosol and into the sterile clays.

Selection of the four units was based upon apparent concentrations of cultural material within the block excavated in an attempt to trace the concentrations by relative density and to define the cultural area. One square was excavated to the east, one to the west, and one to the north of the initial test unit, 11N 60W. Excavation of the units revealed two cultural horizons. The first, an apparent intermittent cultural horizon, was present within the modern sod layer. The second cultural horizon was located at 10-30 cm BGS.

Cultural Horizon (Surface - 10 cm BGS). One KRF flake, described below, was recovered within this layer in each of three 1 x 1 meter units 11N 59-61W.

<u>Material</u>	<u>Size(mm)</u>	<u>#</u>	<u>Wt(g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
KRF	5-10	1	0.2	tertiary	unknown
KRF	10-15	2	0.8	tertiary	unknown

Cultural Horizon (10-30 cm BGS). The second cultural horizon is contained within the dark paleosol (Figure 7). Due to differences in depth of the overlying recent soil zone, the horizon was encountered at 10-20 cm in the shallower western and northern units, and deeper, at 20-30 cm, in the thicker eastern excavated units. The horizon is characterized by a medium-to-sparse scatter of lithic artifacts and bone; no charcoal or cultural features were encountered. Due to the dense carbonate buildup in the cultural zone, a thick lens of calcium carbonate was present on many of the artifacts recovered.

Material Distribution

Forty-two pieces of flaked stone were recovered from the paleosol. Of these, four (9.5 percent) are stone tools. There are three patterned tools (7.1 percent) and a single unpatterned tool (2.4 percent). The remaining 38 artifacts (90.5 percent) are classified as debitage. In addition, 19 unidentifiable large mammal (ULM) bone fragments, possibly representing two pieces and weighing 16.3 g, were recovered from the four excavated units.

The distribution of flaked stone when viewed as a single horizontal plane is presented in Figure 8. Flaked stone tools appear to be randomly spread through the excavated area, one from each 1 x 1 meter unit. However, this may be misleading as all but the side-notched projectile point were recovered from screening. The flaked stone debitage seems to be concentrated to the south and eastern ends of the block with the most dense concentration in Unit 11N 59W (N=15 or 39.5 percent), followed in descending order by Unit 11N 60W (N=11 or 28.9 percent), Unit 11N 61W (N=7 or 18.4 percent), and Unit 12N 60W (N=5 or 13.2 percent). The bone was recovered from the southern portions of Units 11N 59W and 11N 61W (see Table 5, Faunal Remains).

Artifacts Descriptions

As noted in Chapter 3, all artifacts recovered during the present investigation at Sites 32MZ333 and 32MZ334 are of lithic material. Descriptions throughout Chapter 4 will be by the patterned tools, unpatterned tools, and debitage classes earlier defined.

Patterned Tools. Three patterned tools were recovered in the second horizon. They include a projectile point, biface/projectile point midsection, and a biface blank

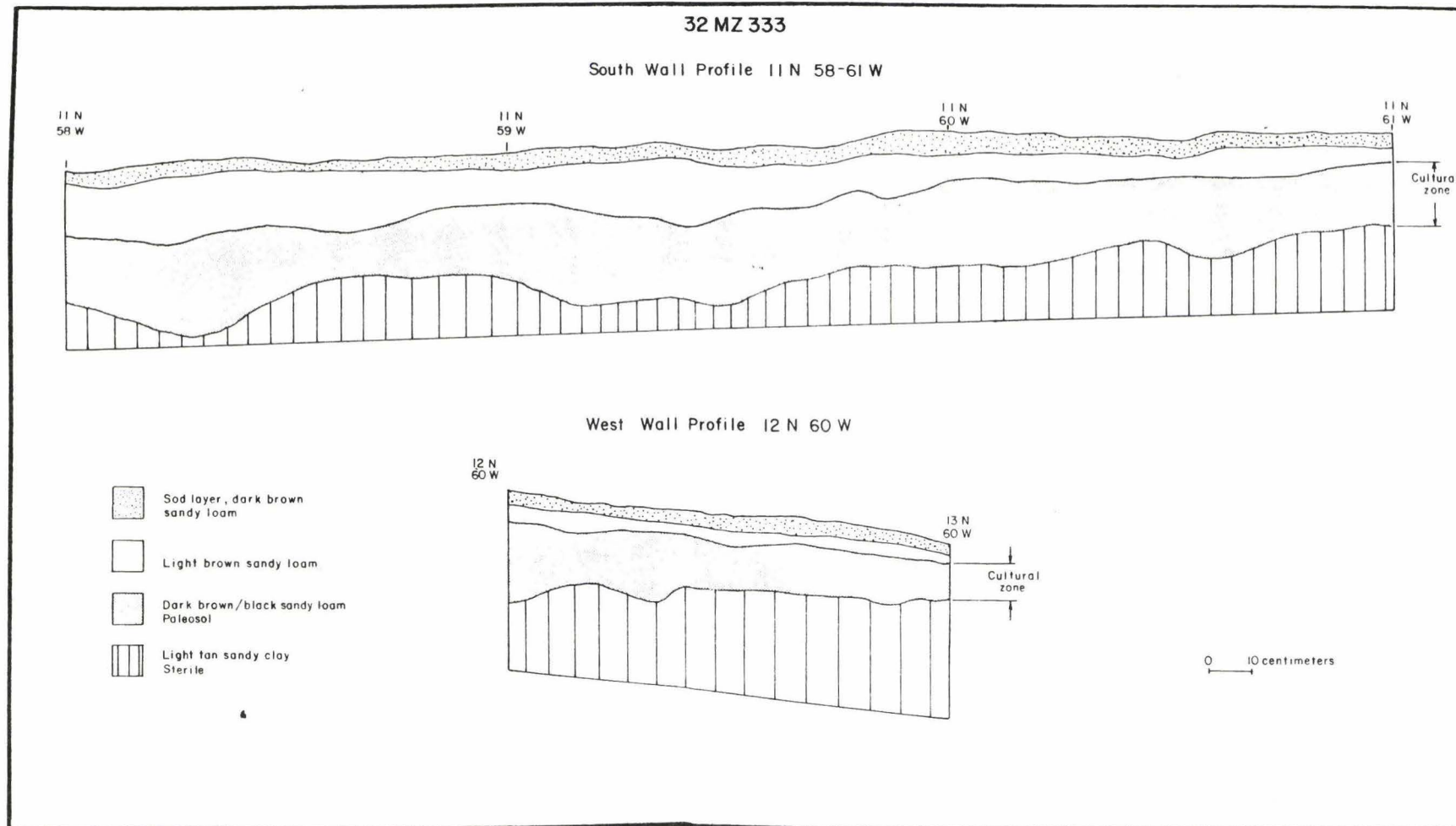


Figure 7

fragment. All three tools are KRF, a material which represents 75 percent of the total tool collection of the horizon in these units.

<u>Projectile point</u> (Figure 9a)	
Raw material	KRF
Weight	2.3 g
Notch width	6.0 mm
Length	39.0 mm
Width	16.0 mm
Blade edge length	31.0 mm
Base length	7.0 mm
Base width	14.0 mm
Neck width	12.0 mm
Notch depth	2.0 mm
Shoulder width	16.0 mm

The artifact was located in the NE $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ of Unit 11N 61W, at a depth of 18 cm BGS (Level 2). The specimen represents a complete triangular projectile point with wide side notches (Figure 9a). The tip is very sharp and pointed, formed by straight-to-slightly-excurvate blade edges, which are very smooth due to an irregular series of pressure flaking. The shoulder is tapered to an expanding stem/hafting area formed by wide, deep side notches. The stem-base junction is a rounded, acute angle and the base is slightly incurvate. The projectile point has not been typed.

<u>Biface/Projectile Point Midsection</u> (Figure 9a)	
Raw material	KRF
Weight	2.5 g
Length	21.0 mm (broken)
Width	19.0 mm
Thickness	5.0 mm

This tool was recovered from Shovel Probe 66 of Transect 1. The specimen represents the midsection of a projectile point; both the tip and basal portions are missing. The artifact is lenticular in cross-section and has straight blade edges which exhibit fine, irregular pressure retouch with no evident use-wear.

<u>Biface/Blank Fragment</u>	
Raw material	KRF
Weight	3.4 g
Length	(incomplete)
Width	26.5 mm
Thickness	8.0 mm

32 MZ 333

4 meter block 11-12 N 59-61 W

Cultural horizon 10-30 cm. B.S.

Debitage distribution/density

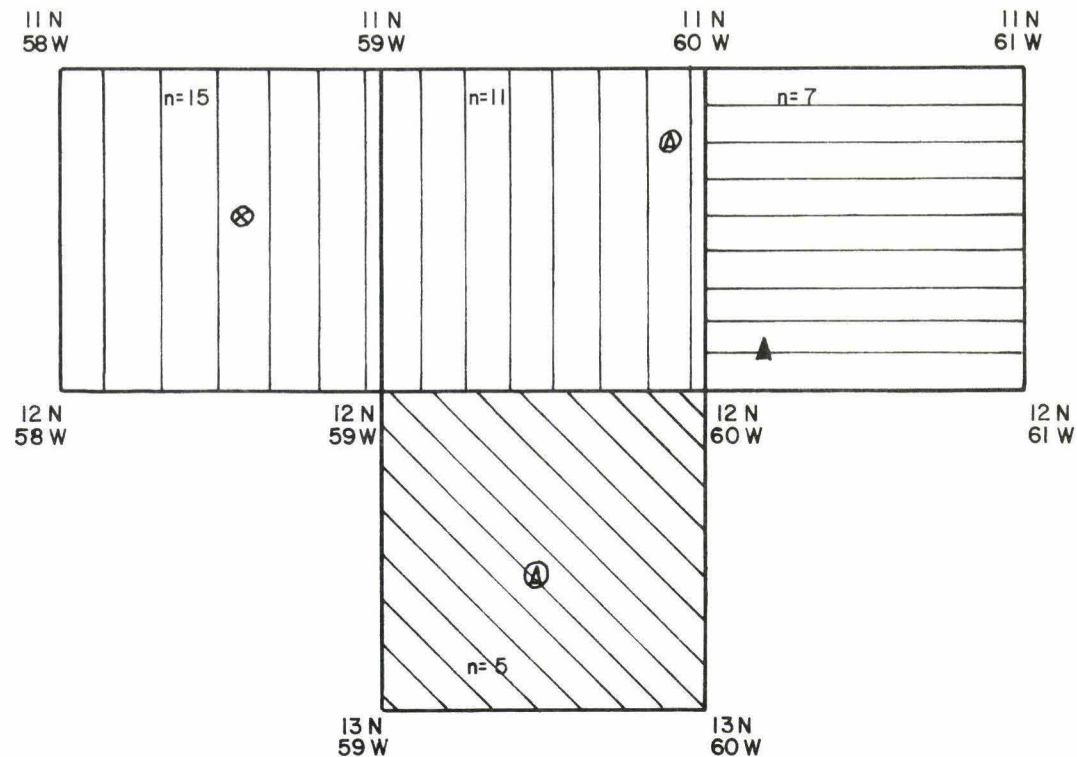
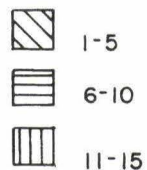


Figure 8

- ▲ Side-notched projectile point 18 cm. B.S.
- ⊕ Projectile point midsection (from screen)
- ⊙ Biface fragment from shovel probe 66 (from screen)
- ⊗ Retouched flake (from screen)

This specimen, a bifacially flaked primary or secondary flake fragment, was recovered from the screen in Level 1 of Unit 12N 60W. The tool's ventral surface shows evidence of three secondary flake removals by direct percussion, while the dorsal surface retains 80 percent cortex. The artifact, which exhibits irregular edges from crude, initial percussion flaking, appears to be a biface/blank broken during the early stages of manufacture.

Unpatterned Tools. A single retouched flake comprises this category. The flake is grey porcellanite, a material representing 25 percent of the total tool collection for this horizon in these units.

<u>Retouched Flake - unifacial</u>	
Raw material	Grey porcellanite
Weight	0.9 g
Length	18.5 mm (broken)
Width	11.0 mm
Thickness	3.5 mm

The flake was recovered from the screen in Level 2 (10-20 cm) of Unit 11N 59W. A deep notch, 4.0 mm wide and 2.5 mm deep, has been pressure flaked into the right lateral edge near the distal end of the flake. The tool, which was manufactured on a small tertiary flake, is plano-convex in cross-section and may have been utilized as a spokeshave for scraping. There is no other evidence of utilization or retouch.

Debitage. Thirty-eight pieces of lithic debitage or non-utilized, unretouched waste material were collected from the paleosol cultural horizon. These waste flakes are summarized in Tables 2 through 4. Four types of raw materials were utilized: KRF (N=29 or 76.3 percent), grey porcellanite (N=5 or 13.2 percent), chalcedony (N=3 or 7.9 percent), and basalt (N=1 or 2.6 percent).

Tertiary flakes comprise the predominant subcategory (Table 2), representing 76.3 percent (N=29) of the total, followed by thinning flakes at 13.2 percent (N=5); secondary flakes, 7.9 percent (N=3); and primary flakes at 2.6 percent (N=1). The tertiary flake class constitutes 100 percent of the porcellanite and chalcedony collection and 72.4 percent (N=21) of the KRF collection.

Fifty percent (N=19) of the waste flakes are 15 mm or smaller (Table 4). The remaining 50 percent are



a.



b.

Figure 9

distributed between 15 and 75 mm with 39.4 percent (N=15) between 15 and 30 mm in size, illustrating the fact that the flakes are fairly uniformly distributed between 5 and 30 mm, with 10.6 percent representing larger flake sizes. No flakes are less than 5 mm. The largest flake, 70-75 mm, is a large primary decortication flake of an igneous material presumed to be basalt.

Table 3 represents an attempt to identify the mode of load application to detach the flakes. Twenty-two flakes or 57.9 percent were not identifiable as to mode. Hard hammer percussion was utilized on one primary and one tertiary flake, representing 5.3 percent of the total debitage. Soft hammer flakes were 16.8 percent tertiary (N=1) and 83.3 percent (N=5) thinning flakes. Direct pressure was utilized on eight tertiary flakes which represent 21 percent of the total debitage collection.

Faunal Remains

Chomko's faunal identification (Appendix 7.4) is presented in Table 5. None of the bone was identifiable by species.

Analysis and Discussion

Of the flaked stone tools recovered, only the complete side-notched projectile point can be considered potentially temporally diagnostic. However, it does not fit neatly into the existing typologies of the Northern Plains and remains undesignated as to type. Exact temporal placement is therefore difficult due to the lack of any associated datable materials. The projectile point was located near the base of the paleosol which has been dated at other areas of the site as Late Archaic. The artifact is believed to represent a probable Late Archaic untyped point variant.

The cultural scatter recovered from the excavation area is sparse and contributes little to an understanding of the specific activities at the site area. Large areas of the site may have been lost to erosion in previous times. The presence of the bone and projectile points suggest a probable short-term hunting camp, possibly representing a single night's activity, based upon the sparse nature of the remains.

The flakes are relatively large but exhibit few secondary and primary flakes indicative of the early stages of

Table 2

Count and Percentage of Raw Materials
By Flake Subcategory for Debitage

<u>Raw Material</u>	<u>Primary</u>		<u>Secondary</u>		<u>Tertiary</u>		<u>Thinning</u>		<u>Total</u>	<u>%</u>
	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>		
KRF	--	--	3	10.4	21	72.4	5	17.2	29	76.3
Grey Porcellanite	--	--	--	--	5	100.0	--	--	5	13.2
Chalcedony	--	--	--	--	3	100.0	--	--	3	7.9
Basalt	<u>1</u>	<u>100</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>1</u>	<u>7.6</u>
Totals	1	2.6	3	7.9	29	76.3	5	13.2	38	100

Table 3

Summary of Unmodified Debitage
By Method of Manufacture

<u>Load Application</u>	<u>Primary</u>		<u>Secondary</u>		<u>Tertiary</u>		<u>Thinning</u>		<u>Total</u>	<u>%</u>
	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>		
Hard Hammer	1	50	--	--	1	50.0	--	--	2	5.3
Soft Hammer	--	--	--	--	1	16.7	5	83.3	6	15.8
Direct Pressure	--	--	--	--	8	100.0	--	--	8	21.0
Unknown	--	--	3	13.6	19	86.4	--	--	22	57.9
	<u>1</u>	<u>2.6</u>	<u>3</u>	<u>7.9</u>	<u>29</u>	<u>76.3</u>	<u>5</u>	<u>13.2</u>	<u>38</u>	<u>100</u>
Totals	1	2.6	3	7.9	29	76.3	5	13.2	38	100

Table 4

Summary of Unmodified Debitage: Weights, Counts,
and Percentages by Raw Material and Group Size

Size (mm)	KRF		Grey Porcellanite		Chalcedony		Basalt		Totals	
	#	Wt	#	Wt	#	Wt	#	Wt	#	%
0-5	--	--	--	--	--	--	--	--	--	--
5-10	8	1.1	1	0.2	1	0.1	--	--	10	26.3
10-15	7	1.6	--	--	2	0.5	--	--	9	23.6
15-20	5	3.4	2	1.2	--	--	--	--	7	18.4
20-25	4	5.9	--	--	--	--	--	--	4	10.5
25-30	3	2.3	1	3.1	--	--	--	--	4	10.5
30-35	--	--	1	8.8	--	--	--	--	1	2.6
35-40	1	5.1	--	--	--	--	--	--	1	2.6
40-45	--	--	--	--	--	--	--	--	--	--
45-50	1	3.5	--	--	--	--	--	--	1	2.6
50-55	--	--	--	--	--	--	--	--	--	--
55-60	--	--	--	--	--	--	--	--	--	--
60-65	--	--	--	--	--	--	--	--	--	--
65-70	--	--	--	--	--	--	--	--	--	--
70-75	--	--	--	--	--	--	1	31.4	1	2.6
Totals	29	22.9	5	13.3	3	0.6	1	31.4	38	100.0
%	76.3		13.2		7.9		2.6		100	

Table 5
Faunal Remains

	<u>ULM</u>	<u>Wt(g)</u>
Unit 11N 59W	18 (probably 1 fragment)	12.5
Unit 11N 60W	<u>1</u>	<u>3.8</u>
Total	19 (2 pieces)	16.3

manufacture. Cores are also absent. Seventy-six percent of the flakes are tertiary, suggesting the latter stages of manufacture; the presence of thinning flakes (13.2 percent) supports this hypothesis. This is true for KRF which is the dominant raw material present (76.3 percent). The relative portion of pressure flakes in the sample, 21 percent (N=8), which also indicates the latter stages of manufacture, adds further support to the hypothesis. However, very fine pressure retouch flakes are missing; none are smaller than 5 mm, and only 26 percent are smaller than 10 mm. Nevertheless, the latter stages of manufacture/maintenance can be assumed, with utilization of soft hammer and pressure techniques.

The lack of additional finished tools and blanks suggests that most of the tools were carried from the site area. The lack of cores suggests the flaking of existing blanks and flakes rather than complete core reduction. This is further supported by the lack of primary and secondary flakes.

4.1.3 Block Excavation North of Road 0N-3S 1E-2W

A 4 x 4 meter excavation unit was placed north of the current Abraxas access road to comply with the Forest Service Scope of Work (Plate 3). This 4 x 4 meter unit was north of the area tested by UNDAR-West in 1981. Placement was determined by the Shovel Probe phase of the site investigations. Shovel Probe 92 of the third transect back across the central site area produced 13 flakes and one bone fragment along with charcoal flecking from the top 14 cm of the probe. Subsequently, a formal 1 x 1 meter excavation unit (2S 1W) was placed over this probe. Encountered within this unit were 580 waste flakes and three biface fragments, with bone, charcoal, and a fire hearth (Feature 1). Associated with Feature 1 was a Besant phase projectile point base (Figure 15a). Based upon the high density of cultural materials, adjacent units were subsequently opened to the full 4 x 4 meter unit. When finished the 4 x 4 unit covered excavation units 0N-3S 1E-2W from the central site datum.

Stratigraphy

The stratigraphy for the formal 1 x 1 meter unit as determined by the initial shovel probe is extremely simple. From the modern surface to 13.5 cm, a dark brown sandy

loam, representing the base of the paleosol, is present over the entire central site area. The recent upper soil zone of light brown sandy loam has eroded away, as has a portion of the paleosol. All cultural materials were confined to the paleosol, beneath which is a light brown, heavily calcareous sand (see Figure 10, Profiles).

Excavation Methodology

Natural stratigraphy was utilized in the excavation of this 4 x 4 meter unit. The entire paleosol was removed as one level to the top of the underlying calcareous sands, which are readily distinguished by the dramatic color and textural change. The depth of this level varied over the excavated site area from ca. 8 to 14 cm.

Two 1 x 1 meter units within the 4 x 4 meter block were then excavated to 50 cm to verify that the lower calcareous sands were culturally sterile. Excavation was by 10 cm arbitrary levels from the base of Level 1 to the base of each unit at 45-50 cm. The selection of units opened was determined by the presence of the features and by tracing the most dense areas of cultural materials.

Cultural Horizon at Level 1 (0-14 cm BGS)

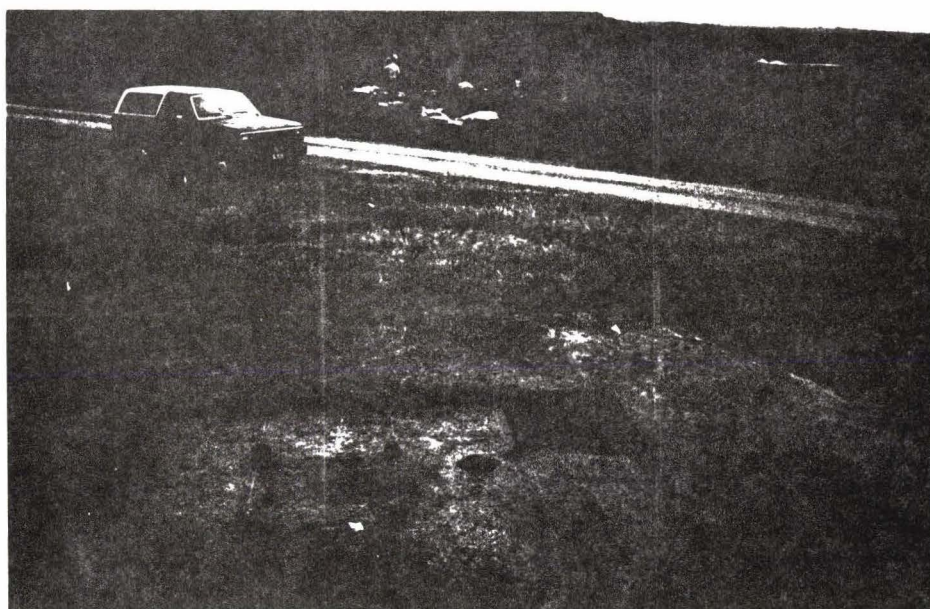
The single cultural horizon was encountered from the modern sod layer to approximately 14 cm in depth. Most of the cultural materials were encountered within the basal seven cm of the level. This cultural horizon is characterized by dense amounts of lithic artifacts, bone and burned bone fragments, charcoal and ash flecking, and the presence of features and cultural staining of the surrounding matrix.

Features and Stains

Feature 1

Feature 1 appears to be a fire hearth found in the south central portion of the 4 x 4 meter block in Units 2S 0W and 2S 1W (Plate 4a). The feature measured approximately 45 cm and was roughly circular in shape. The oxidized, reddened stain extended five cm deep (see Figure 11) and was first encountered at about eight cm in association with cracked rock, charcoal, ash, and burned bone fragments.

Plate 3



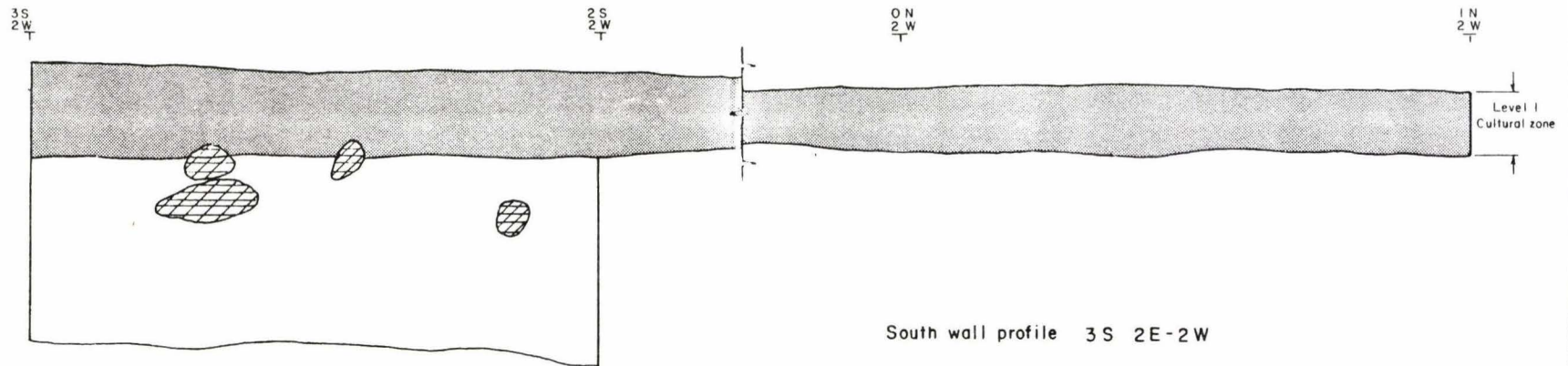
32MZ333 Overview

4 x 4 meter unit north of road,
foreground

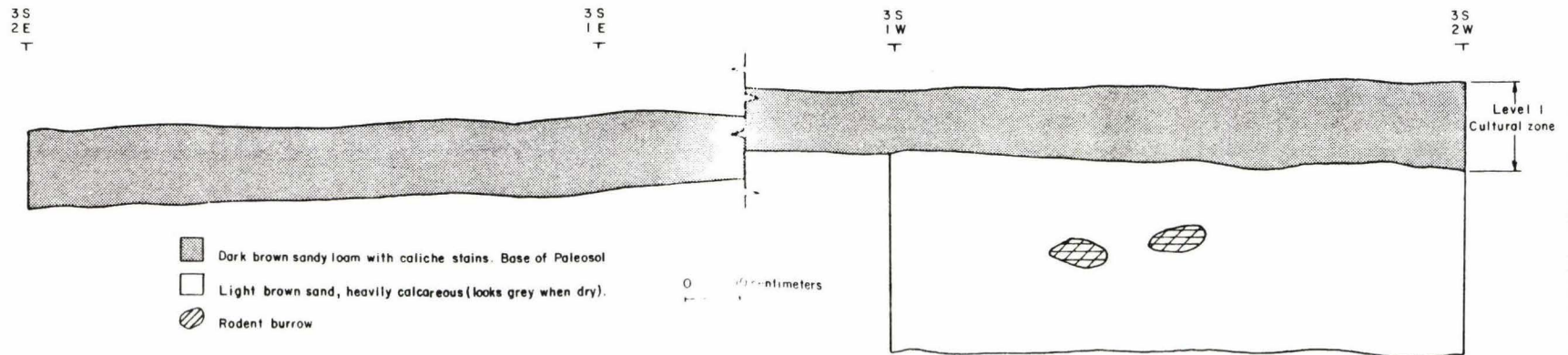
4 x 4 meter unit south of road,
background

32 MZ 333

West wall profile 3S-1N 2W



South wall profile 3S 2E-2W



- Dark brown sandy loam with caliche stains. Base of Paleosol
- Light brown sand, heavily calcareous (looks grey when dry).
- Rodent burrow

0 centimeters

Figure 10

The upper portion of the feature was indistinct and poorly defined. Removal of the cultural matrix to the base of Level 1, at the bottom of the feature, revealed a well defined, dark red, oxidized ring of burned earth. The portion of the feature lying in 2S 1W exhibited a red outer ring with a darker, black area in the center. The central fill portion contained a corner-notched Besant point base, a flake tool, rock fragments, and a concentration of 52 flakes. The eastern portion of the feature was less well defined. The distinct red outer ring was absent, and the area contained only the darker, black fill. The flake density was lower and there were no rock fragments. The partial red ring, the dark area, and the rock concentrations appear to represent an episode of local in situ burning.

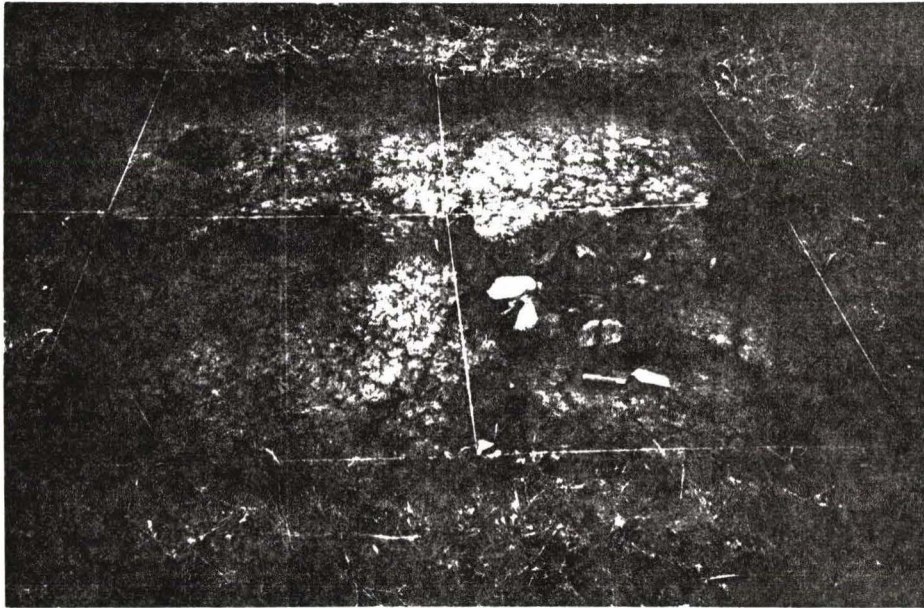
There was no circular ring of hearthstones. Instead, rock fragments were scattered randomly within and generally north-east of the hearth feature, toward Feature 3. While there was a small depression, no evidence of a deeply excavated basin or pit existed. The hearth appears to have been fired on the surface and burned long enough to create the reddened stain, darker ash, and charcoal scatter around the feature. The feature fill was retained for further analysis of pollen, floral remains, and possible dating.

The pollen analysis displayed only minor differences in relative frequencies of taxa between this level and lower strata, including slight increases in Juniperus, Pinus, and Graminae, and slight decreases in Artemisia and Populus. Flotation of Feature 1 fill revealed burned and unburned grass fragments, and unburned twigs, Graminae, catkins, and bud tips (Scott 1982, Appendix 7.5). A radiocarbon date of 1400 ± 50 B.P. was obtained, but the two obsidian dates of 2006 ± 52 B.P. and 2041 ± 24 B.P. are much more consistent with dates of other features in the same stratigraphic position. The radiocarbon date has been rejected because of suspected rodent burrow contamination (Appendices 7.1, 7.2).

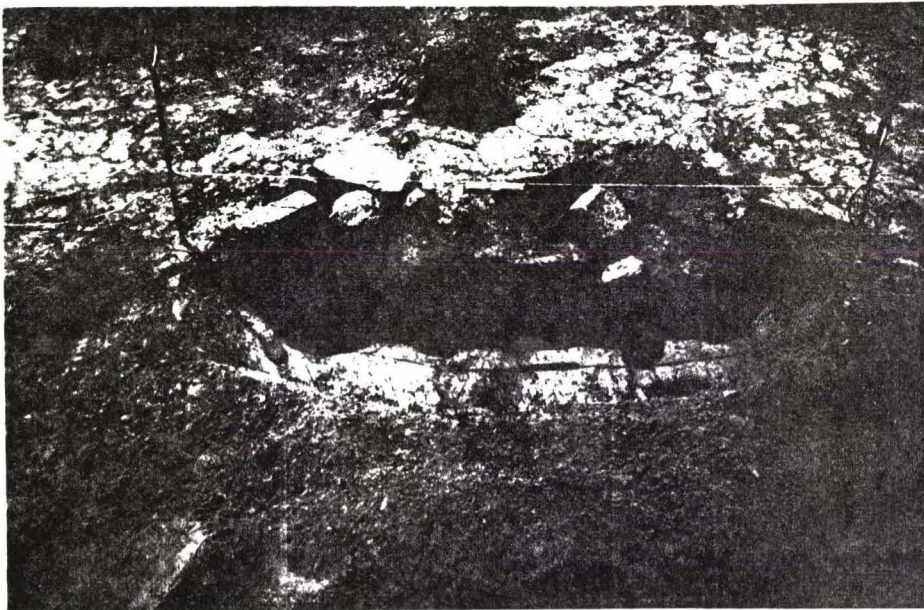
Feature 3

Feature 3 was a large concentration of fired and fire-cracked rock located in the easternmost portion of 1S 1W and the western portion of 1S 0W (Plate 4b). The feature measured 109 cm on the long axis, northwest to southeast, and 79 cm on the short axis, northeast to southwest, and extended in depth from -5.0 cm below datum on the highest rock surface to -16.0 cm below datum at its base. The first evidence of the feature was encountered at about 5 cm BGS and expanded

Plate 4



4a. 32MZ333 Features 1 and 3, facing west



4b. 32MZ333 Feature 3, in profile

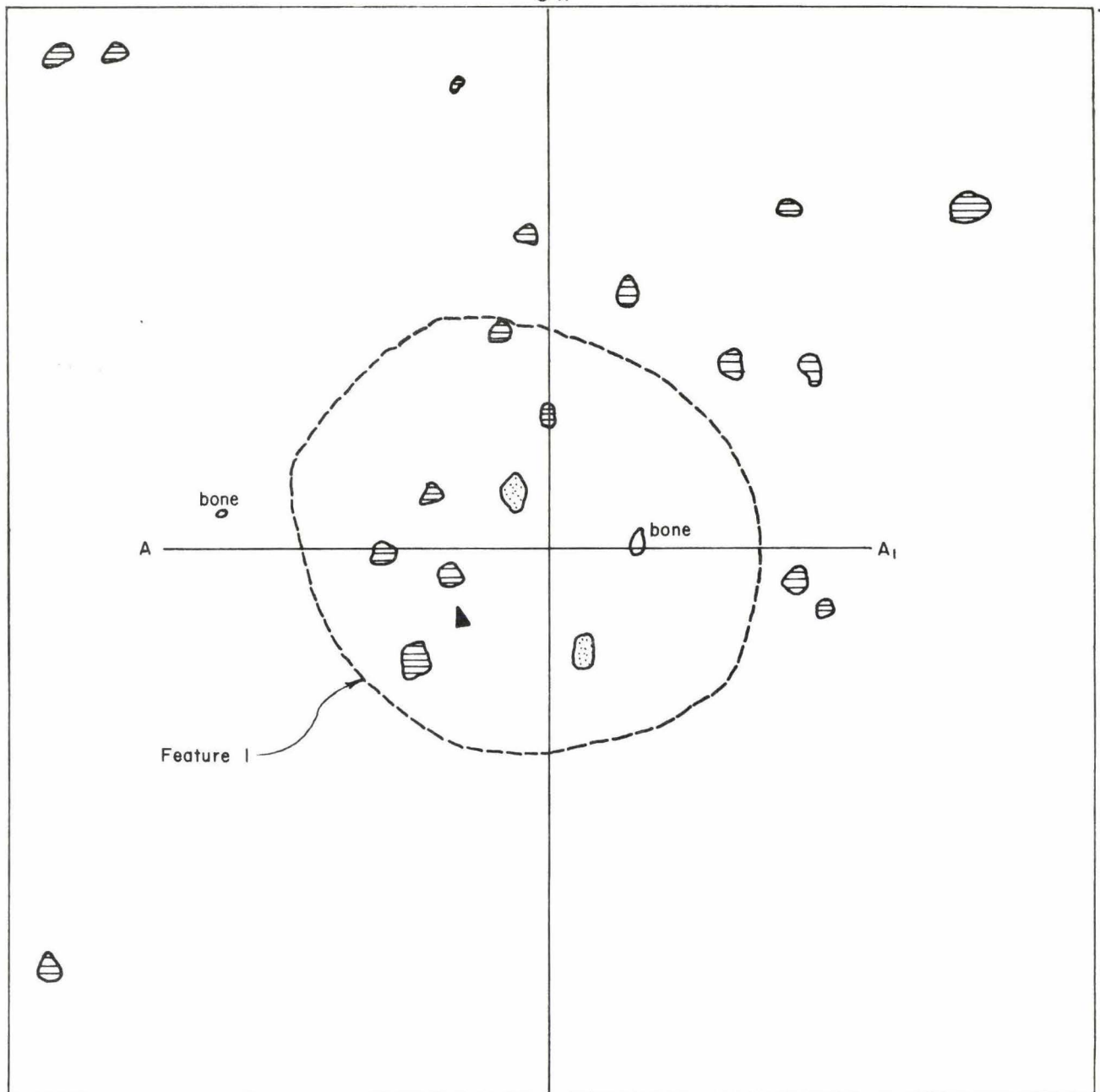
32 MZ 333

Feature I

1 S
.5 W

1 S
OW

1 S
.5 E



Plan view:

- ▲ Projectile Point Base (Besant)
- ▨ Knife River Flint Flake Tool
- ⊖ Fire Cracked Rock

Profile:



Figure 11

outward and downward through the entire cultural Level 1 (see Figures 12 and 13). The predominant lithology of Feature 3 is overwhelmingly granite, followed by gabbro, limestone, sandstone, and quartzite. The specific rocks and respective weights are outlined in Table 6.

Feature 3 is located approximately 80 cm north and slightly east of Feature 1, with which it is very likely associated. The Feature 3 stones may have been stock piled for stone boiling, although many are much too large for normal stone boiling activities. The feature appears to be resting in a small pit or depression (Figure 13, Profile), and the rocks may be the scattered remnants of a roasting pit. This is suggested by the flotation results, which showed burned and unburned grass fragments and some unburned insect fragments. No dates were obtainable from this feature.

If the rocks comprising Feature 3 represent a roasting pit, they would have been heated in the hearth (Feature 1), and then placed within the basin. Meat would then have been placed among the heated rocks and covered with additional stones for roasting purposes. The rocks are obviously heat altered; many are fractured and heat cracked and were clearly at one time a single large rock. The scatter of small cracked rocks in Feature 1 and the general scatter of rocks trending northeast-southwest between Features 1 and 3 provide additional evidence for their association. Both the feature fill and the unit in general contained scattered flakes and bone. A biface fragment was also located just north of Feature 3. The largest rock in Feature 3 measured 14.5 cm; the smallest was two cm.

Stain/Concentration Areas

Three small, amorphous stains of slightly reddened, oxidized earth were noted during the excavations; two of the three stains were associated with a marked increase in the concentration of lithic debris. This is especially true of the stain/concentration designated Stain 1.

Stain 1 was located along the southwestern edge of the 4 x 4 m unit along the 2S line between squares 2S 2W and 3S 2W. The stain, measuring approximately 30 cm, was extremely amorphous. As the surrounding matrix dried in the sun, the stain became impossible to distinguish from the Level 1 matrix. The feature was first noted due to the dramatic increase in lithic and bone debris encountered in the small area. Lithic artifacts recovered from the stained area numbered 386. Additionally, several bison teeth and unidentified bone fragments were present. The concentration began at about eight cm BGS and continued to the base of the level, one-two cm deeper than the surrounding areas. A lesser amount, 168 pieces of stone debitage, was recovered from 3S 2W. No additional bone was recovered from these units.

32 MZ 333

Plan View Feature 3

Units | south O west

| south | west

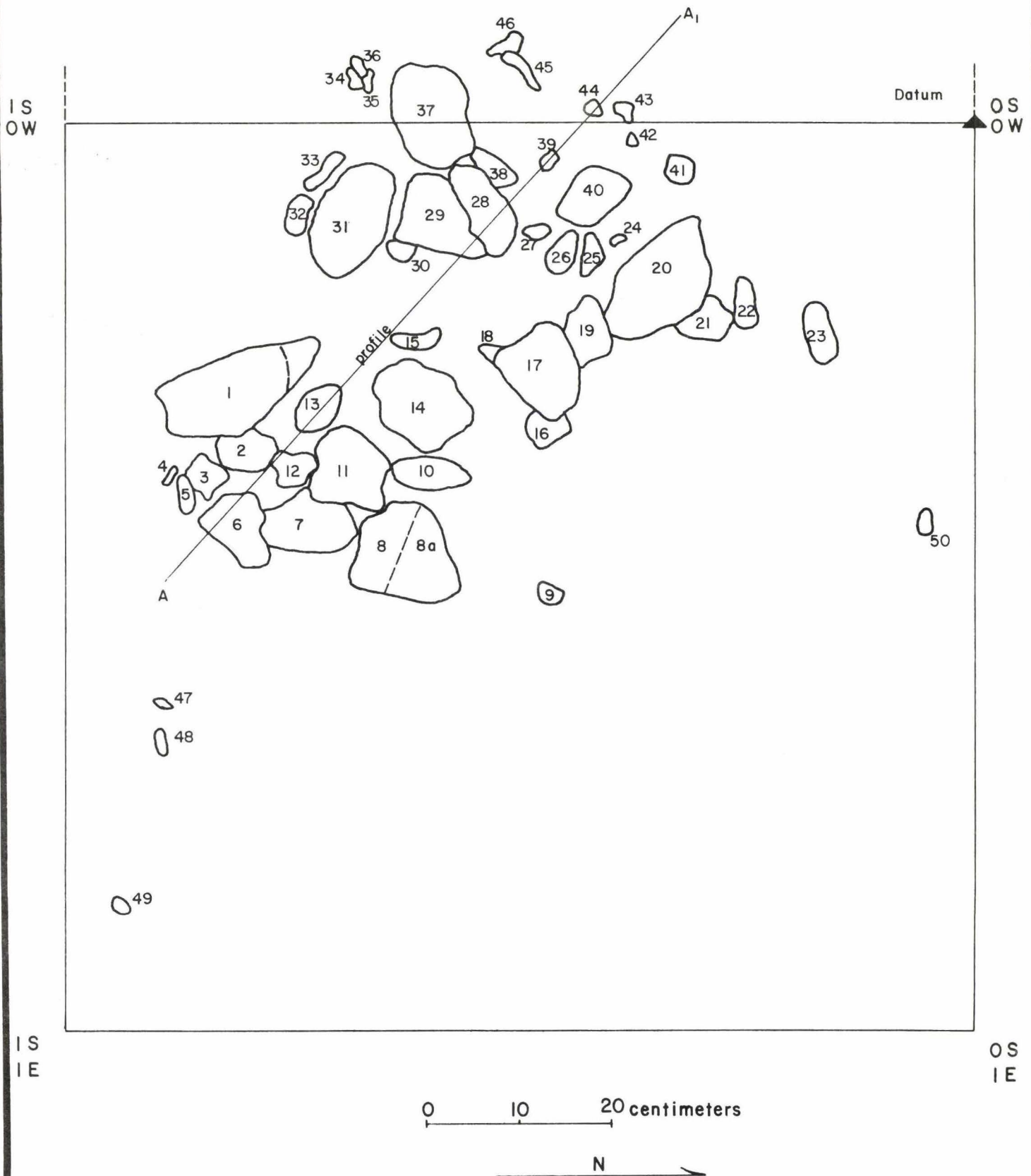


Figure 12

32 MZ 333

Feature 3 Profile

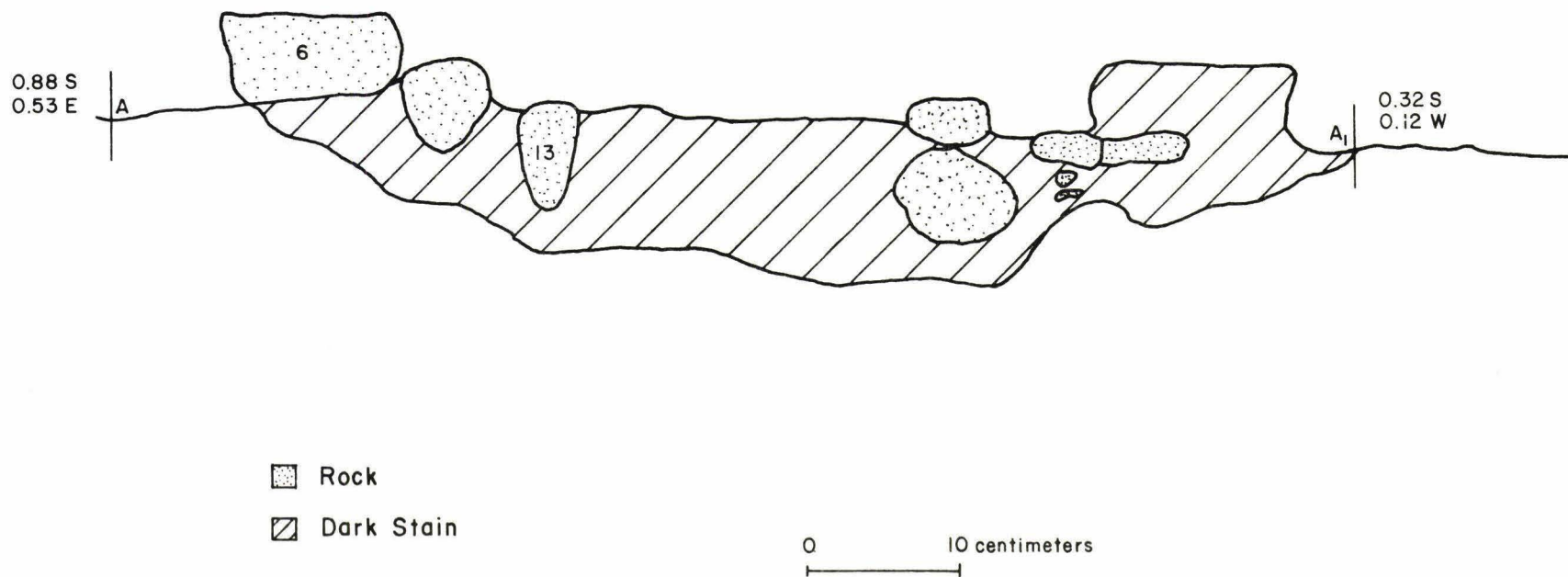


Figure 13

Table 6
32MZ333 Feature 3 Fired and
Fire-Cracked Rock

<u>Field Number</u>	<u>Origin</u>	<u>Material</u>	<u>Weight (g)</u>
1	Sedimentary	Limestone	900.0*
2	Igneous	Granite	506.6
3	"	"	277.8
4	"	"	19.0
5	"	"	66.7
6	"	"	591.9
7	"	"	847.1
8A	"	"	1154.2
8	"	"	460.9
9	Sedimentary	Sandstone	3.7
10	Igneous	Granite	652.4
11A	"	"	77.0
11	"	"	273.8
12	"	"	155.8
13	"	Gabbro	545.6
14	"	Granite	1000.0*
15A	"	"	21.2
15	"	"	161.0
16	Sedimentary	Sandstone	27.0
17	Igneous	Granite	750.0*
18A	"	Gabbro	7.7
18	"	"	23.5
19	"	Granite	364.1
20	"	"	2000.0*
21	"	"	125.5
22	Metamorphic	Quartzite	52.3
23	Igneous	Granite	73.2
24	"	"	2.4
25	"	"	40.3
26A	"	"	12.2
26	"	"	398.8
27	"	"	43.
28	"	"	107.6
29	"	"	367.7
30	"	Gabbro	211.7
31	"	"	1000.0*
32	"	Granite	211.0
33	"	"	237.7
34	"	"	4.1
35	"	"	129.7

*Approximate weights

Table 6 (Continued)

<u>Field Number</u>	<u>Origin</u>	<u>Material</u>	<u>Weight (g)</u>
36	Igneous	Granite	5.7
37	"	"	778.7
38	"	"	129.2
39A	"	"	156.9
39	"	"	7.4
40			
41	"	"	19.5
42	"	"	6.7
43	"	"	47.3
44	"	"	31.5
45	Sedimentary	Sandstone	30.2
46	"	"	32.7
47	Igneous	Granite	6.8
48	"	"	4.0
49	"	"	4.8

Miscellaneous Unnumbered
Rock Fragments

<u>Total Number</u>	<u>Origin</u>	<u>Material</u>	<u>Weight (g)</u>
4	Sedimentary	Sandstone	163.6
1	"	"	287.1
1	Igneous	Granite	540.2
1	"	"	768.0
3	"	"	550.6
11	"	"	455.3
30	"	"	317.7
22	"	"	79.2
1	"	Gabbro	498.1
4	"	"	464.1
2	"	"	481.7

Similar small stains were located between 3S 1W and 2S 1W (Stain 2, originally recorded as Feature 2) and in 1S 2W (Stain 3). While Stain 3 was also associated with an increase of lithic debris, ca. 25 pieces, no substantial increase was noted in Stain 2.

The presence of reddened stains of highly oxidized matrix is not due to in situ burning; the stains are very amorphous, not concentrated, and show little depth or intensity as does Feature 1, which has been defined as a hearth. However, the red stains are obviously the result of oxidation or burning of the surrounding matrix.

The exact nature of these stains remains unknown. However, they appear to represent the results of hearth cleaning activities from Feature 1, based on the presence of the reddened earth, bone and charred bone fragments, a burned chert flake, and the increased amount of lithic materials as represented by the concentration of debris in and around Feature 1. This is especially true for Stain 1. Furthermore, it suggests a prolonged stay at the campsite which would have necessitated cleaning the hearth fill.

Material Distribution

A total of 3,247 pieces of flaked stone were recovered from the cultural horizon in Level 1. Of these, 22 (0.7 percent) were identified as stone tools: 11 (0.35 percent) patterned and 11 (0.35 percent) non-patterned stone tools. The remaining 3,225 stone artifacts (99.3 percent) were classified as debitage. In addition, 117 unidentifiable large mammal (ULM) bone fragments, 85 ULM charred bone fragments, three unidentifiable small mammal (USM) bone fragments, one USM charred bone fragment, and four bison deciduous tooth fragments were recovered (Chomko, Appendix 7.4).

The bone fragments were concentrated in and around the defined features and stains. Density of bone decreased in direct proportion to distance from the features. However, less than 50 g of bone were recovered in the entire excavation unit. The bone distribution by unit is presented in Table 7.

The flaked stone debris is likewise non-randomly distributed through the excavation units. The flaked stone material distribution is presented in Figure 14. The most densely concentrated flaked stone, 18 percent of the total debitage (N=580), was present in square 2S 1W, just west of Feature 1.

The second most dense concentration, 403 pieces of debitage (12.5 percent), was in square 3S 0W just southeast of Feature 1. The flaked stone density then drops rapidly to the north of Feature 3 but remains fairly dense in the remaining area of the 4 x 4 m unit. This suggests that the majority of lithic manufacture/maintenance occurred in the immediate vicinity of Feature 1 and generally south of Feature 3.

Table 7

Bone Fragments from ON-3S 1E-2W
By Excavation Unit

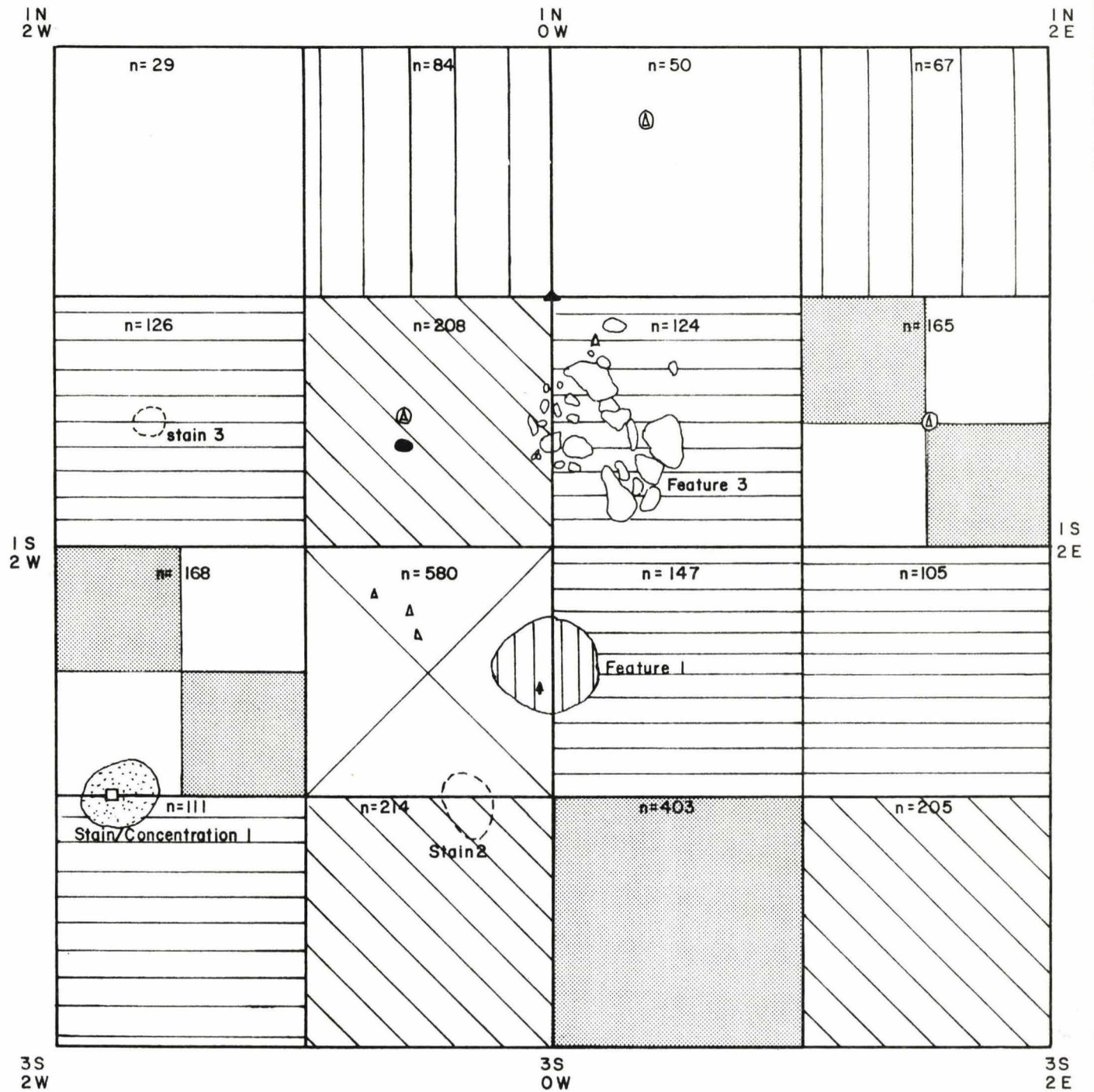
Excavation Unit	Unidentifiable Large Mammal	Wt (g)	ULM Charred	Wt (g)	Unidentifiable Small Mammal	Wt (g)	USM Charred	Wt (g)	Identified Bones	Wt (g)
ON 1E	1 3	7.1 0.9	2	0.6						
ON 1W	1	1.1							"bone flake"	
1S 1E	5	0.7	2	0.6						
1S 0W	36	2.0								
1S 1W	2	0.4	1	0.1	1	<.1				
2S 0W Feature 1	6 14	0.9 2.4	6 2	0.6 0.2						
2S 1W	5	0.7	21 32	5.1 2.2	1	<.1				
2S 2W Stain/Con- centration	7	1.6							I, R Bison Deciduous	0.4
3S 1E			1	1.0			1	0.2		
3S 1W	10 3 4	1.0 6.1 0.3	5 13	0.6 0.9	1	<.1				

Table 7 (Continued)

Excavation Unit	Unidentified Large Mammal	Wt (g)	UIM Charred	Wt (g)	Unidentified Small Mammal	Wt (g)	USM Charred	Wt (g)	Identified Bones	Wt (g)
3S 2W	16 4	2.6 0.4							R Bison I 2 or 3 deciduous I ₃ R Bison deciduous	0.4 0.2
Totals	117	28.2	85	11.9	3	<.3	1	0.2	4	0.7

32 MZ 333

Plan View 0 N-3S, 1 E-2W, Level 1 (Cultural Horizon)



- ◆ Besant Projectile Point Base
- △ Biface Fragment
- End Scraper
- Biface Blank / Drill
- ⊙ Artifact from screen

1-50	251-300
51-100	301-350
101-150	351-400
151-200	401-450
201-250	450 +

Figure 14

This contention is also supported by the distribution of stone tools from the excavated area. The projectile point base was recovered within Feature 1. Three additional biface fragments, mainly biface blanks broken during manufacture, were found in 2S 1W just west of Feature 1. The endscraper and two additional bifaces were located slightly north of Feature 1 and west of Feature 3 in 1S 1W. An additional biface was recovered on the north edge of Feature 3. The biface/drill was found in Stain 1, which appears to represent the remnants of hearth cleaning from Feature 1. In addition, a large flake tool was recovered from Feature 1.

The above information indicates that the major lithic reduction/maintenance activities occurred in the immediate vicinity of Features 1 and 3, concentrated generally to the south, with less activity occurring along the northern tier of the 4 x 4 m unit. The same distribution is true of the bone fragments with the majority occurring in the immediate vicinity of the cultural features and stains. In addition, most of the artifacts were located in the lower seven cm of the level, which coincides nicely with the location of the features, at the base of Level 1.

Artifact Descriptions

Of the 3,247 pieces of flaked stone, 22 (0.7 percent) were classifiable as stone tools. Eleven of these (0.35 percent) were patterned, and 11 (0.35 percent) were unpatterned. The remaining 3,225 lithic artifacts were classified as debitage.

Patterned Tool

<u>Projectile Point</u> (Figure 15a)	
Raw material	KRF
Weight	2.4 g
Length	(incomplete)
Width	23.0 mm
Thickness	5.0 mm
Stem length	9.0 mm
Stem width	21.0 mm
Neck width	15.0 mm
Notch width	7.0 mm
Notch depth	4.0 mm
Shoulder width	23.0 mm

This artifact was recovered from the Feature 1 fill at 1.56 meters south and 0.08 meters west at a depth of nine cm below datum. The specimen represents the basal end of a projectile point broken through the midsection, and exhibits deep, finely flaked corner notches with an acute rounded stem-base juncture. The stem base is finely

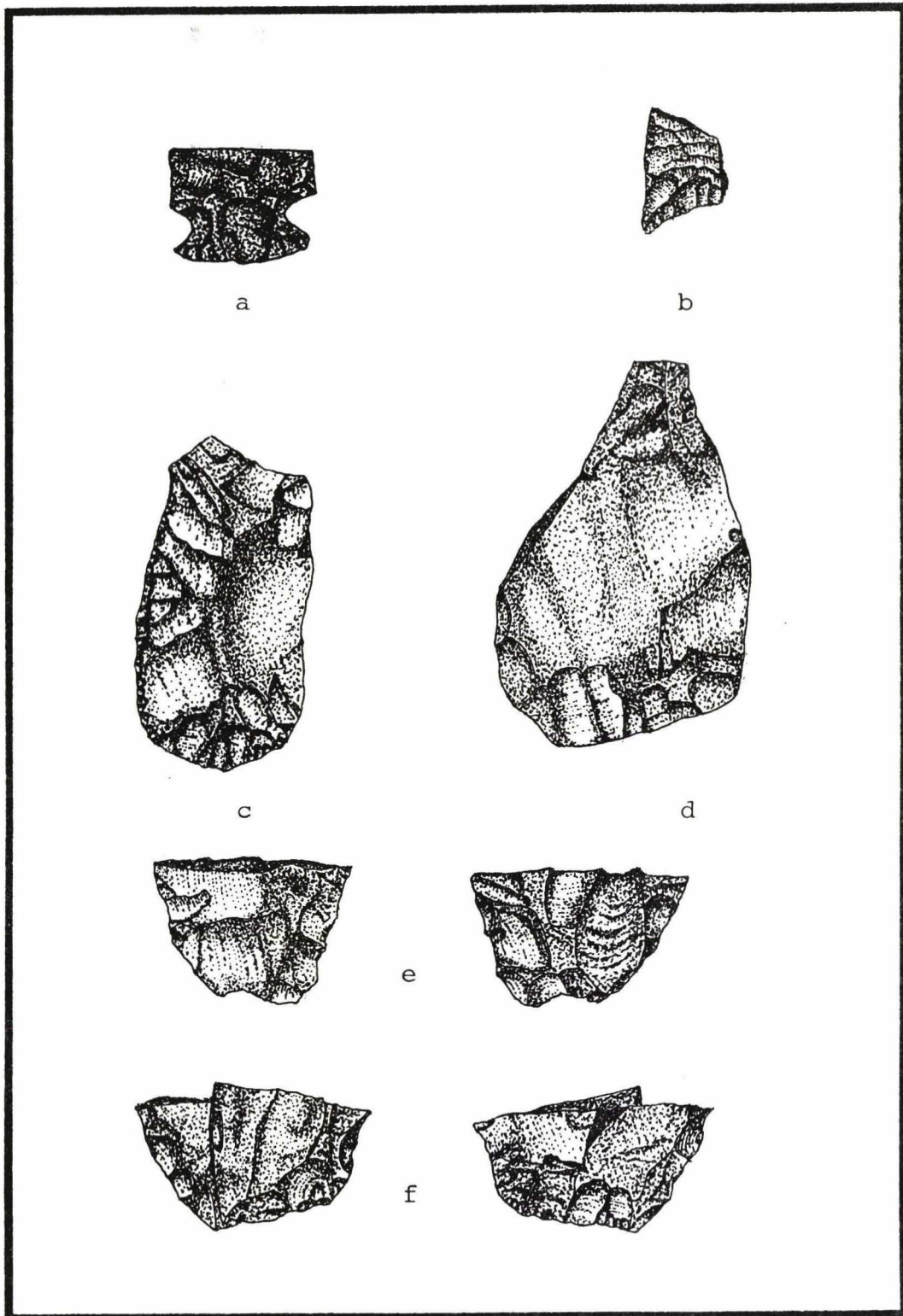


Figure 15

thinned and slightly excurvate; the cross-section is lenticular. This projectile point has been typed as Besant based on similar specimens from Wettlaufer (1960), Plate 13-3; and Frison (1978), Plate 5.40-e.

Biface/Preform (Figure 15b)

Raw material	chalcedony
Weight	1.1 g
Length	18.5 mm (incomplete)
Width	15.0 mm (incomplete)
Thickness	4.0 mm

This artifact was recovered from screening in Unit CN CW from Level 1. The specimen represents a small, finely pressure flaked biface that has been fractured across the midsection and on a lateral edge. It is finely thinned and shaped by pressure retouch. The basal portion bears one distinctively flaked ear: one side has been broken away. The artifact has been classified as a possible preform due to the small size, excellent quality of workmanship, and general outline shape.

Side and End Scraper (Figure 15c)

Raw material	KRF
Weight	18.1 g
Length	55.0 mm
Width	26.5 mm
Thickness	12.0 mm
Length of Retouched Edge	6.0 mm

This specimen was recovered 0.59 meters south and 0.59 meters west at nine cm below datum. The artifact was manufactured on a large thinning flake of KRF and is plano-convex in cross-section. The tool exhibits retouch along the dorsal surface on the distal and right lateral edges. The distal edge is not characterized by steep distal retouch; the edge angle is only 36 percent. The steep retouch is located along the lateral edge with an edge angle of 60 percent.

Drill (Figure 15d)

Raw material	KRF
Weight	27.0 g
Length	61.0 mm (incomplete)
Width	41.0 mm
Thickness	12.0 mm

This artifact was located in Stain 1 at the base of Level 1 in square 2S 2W. The artifact was manufactured on a large KRF flake blank; one side is heavily patinated. The base is bifacially flaked by soft hammer percussion and appears to have been a large blank broken during manufacture. The distal edge of the broken blank appears to have been fashioned into a drill with a distinctive diamond-shaped cross-section. The drill bit was subsequently broken and is missing from the artifact.

Blank (Figure 15e)

Raw material	Grey porcellanite
Weight	15.3 g
Length	49.0 mm (incomplete)
Width	33.0 mm
Thickness	10.0 mm

The blank is broken through the midsection. One fragment (Figure 15e) was recovered at 1.18 meters south, 0.72 meters west at three cm below datum. The other fragment was recovered from the screened bulk materials. The artifact was manufactured from a large secondary flake of grey porcellanite, probably by soft hammer percussion. The flake is bifacially edged and thinned. It was later fractured during manufacture and discarded. The basal portion exhibits two flake removals from the ventral side after the initial break, using the fracture surface as a platform (Figure E2). The artifact is biconvex in cross-section.

Blank (Figure 15f)

Raw material	KRF
Weight	7.2 g
Length	23.0 mm (incomplete)
Width	37.0 mm
Thickness	8.5 mm

This artifact was recovered at 1.33 meters south, 0.54 meters west at seven cm below datum, and was manufactured on a tabular core of KRF with cortical surfaces on either side. The specimen is edged and was broken during further manufacture. As the artifact was broken in the early stages of manufacture, it has been classified as a blank; it is lenticular in cross-section.

Biface Tip

Raw material	KRF
Weight	0.1 g
Length	8.0 mm
Width	10.5 mm
Thickness	3.0 mm

This artifact was recovered from screening Level 1 in Unit 1S 1E; it represents the very tip of a bifacial implement exhibiting evidence of both soft hammer percussion and pressure retouch. The specimen is lenticular in cross-section. It is not known whether the artifact was broken from a finished implement or fractured during manufacture.

Biface Lateral Edge Fragments

Raw materials	KRF	KRF	KRF
Weight	0.7 g	1.8 g	5.0 g
Length	18.0 mm (incomplete)	23.0 mm	32.0 mm
Width	9.0 mm (incomplete)	15.0 mm	18.5 mm
Thickness	5.0 mm	6.0 mm	9.0 mm

These three artifacts were located at 1.26 meters south, 0.59 meters west; 0.18 meters south, 0.19 meters east; and from screening Level 1 in Unit 1S 2W at a depth of 5.5-8.0 cm BGS. Each represents the lateral edge of a larger bifacial implement with the top, bottom, and one lateral edge missing, and is totally undiagnostic. Two of the artifacts have one cortical surface and bear evidence of percussion flaking, suggesting possible breaks during manufacture. The remaining fragment is larger and evidences fine pressure retouch and heavy use wear or grinding along the working edge. The artifact may have been used for scraping.

Unpatterned Tools

Retouched Flake

Raw material	Coarse chert
Weight	12.2 g
Length	48.0 mm
Width	46.0 mm
Thickness	6.5 mm

The flake was recovered from the screening of Level 1, 0N 1E. The artifact is a bifacially flaked primary flake. The ventral surface bears evidence of at least two flake removals subsequent to the initial detachment. The dorsal surface has three negative flake scars along the proximal end. In addition, the left lateral margin shows evidence of use-wear, probably in a cutting motion, as a knife would.

Utilized flakes. (See Table 8 for measurements.)

Three of the utilized flakes are thinning, two are secondary, and the remaining seven are tertiary flakes. The

flakes were located in Units 1S 0W (3), 1S 1E (4), 2S 0W (2), 2S 2W (1), 2S 1W (2), and 1S 1W (1). The 12 flakes are utilized on a total of 10 edges and one projection. Both cutting and scraping functions on hard and soft material are indicated.

Eighty-two percent (N=9) of the patterned tools are KRF, 9 percent (N=1) are chalcedony, and 9 percent (N=1) are grey porcellanite. Eight percent (N=1) of the unpatterned tools are chert, and 92 percent (N=11) are KRF. Of the total tools, 87 percent (N=20) are KRF, and 4 percent (N=1) are chert, chalcedony, and grey porcellanite.

Debitage

From 0N 3S 1E 2W, 3,225 pieces of lithic debitage were collected. Tables 9 through 12 provide a summary breakdown of the lithic debitage. Seven raw materials were identified within the assemblage. The most frequently used material was KRF at 84 percent of the total debitage (N=2,709); followed by chalcedony at 11.1 percent (N=358); grey porcellanite, 1.83 percent (N=59); chert, 1.24 percent (N=40); obsidian 1.4 percent (N=45); with petrified wood and red porcellanite each at less than 1 percent of the total.

Tertiary flakes constituted the largest flake subcategory with 87 percent of the total (N=2,811). Next were secondary flakes at 6 percent (N=190), followed by thinning flakes at 6 percent (N=185), and primary flakes at 1.0 percent (N=39). This pattern is true for each of the raw materials except petrified wood. Tertiary flakes are, in all cases, the largest flake category followed by secondary flakes as the next largest category represented. However, for petrified wood, the largest flake category is secondary flakes (N=8 or 61.5 percent), followed by primary flakes (N=4 or 30.8 percent), and tertiary flakes (N=1 or 7.7 percent). No thinning flakes were present in the collection of petrified wood.

The flake size distribution is presented in Table 9. This table clearly shows that the flake size is heavily weighted toward smaller flakes, with 66.25 percent (N=2,138) of the flakes being smaller than 10 mm in maximum dimension. Of the total collection, 89.95 percent (N=2,901) are smaller than 15 mm in maximum dimension. The same distribution of flake size is true for all the material present in the collection. Only 10.05 percent of the flakes are larger than 15 mm.

Table 8
UTILIZED FLAKES

Raw Material	KRF	KRF	KRF	KRF	KRF	KRF	KRF	KRF	KRF	KRF	KRF	KRF
Weight (g)	4.6	5.1	3.0	1.0	3.2	1.8	2.8	1.1	1.1	1.4	2.2	1.5
Lenght (mm)	52.0	39.0	28.0	23.5	11.5	24.0	25.0	13.5	22.0	24.0	24.0	20.0
Width (mm)	24.0	18.0	25.0	17.0	33.5	16.5	25.0	19.0	12.0	18.0	12.0	21.5
Thickness (mm)	5.0	9.5	5.0	3.0	5.0	4.5	4.5	5.0	6.0	2.5	4.5	3.5

Table 9

Summary of Unmodified Debitage: Counts
and Percentages by Raw Material and Group Size

Group Size (mm)	KRF	Chalcedony	Grey Porcellanite	Chert	Obsidian	Petrified Wood	Red Porcellanite	Total	%
0-5	356	80	9	--	8	--	--	453	14.00
5-10	1397	209	35	16	26	2	--	1685	52.25
10-15	673	56	6	16	8	4	--	763	23.70
15-20	213	10	7	3	3	2	1	239	7.41
20-25	51	1	--	3	--	--	--	55	1.70
25-30	15	2	2	2	--	2	--	23	0.72
30-35	3	--	--	--	--	1	--	4	0.12
35-40	--	--	--	--	--	--	--	--	--
40-45	1	--	--	--	--	1	--	2	0.06
45-50	--	--	--	--	--	1	--	1	0.03
Totals	2709	358	59	40	45	13	1	3225	99.99
%	84.0	11.1	1.83	1.24	1.40	0.40	0.03	100	

Table 10

Count and Percent of Raw Materials
By Flake Subcategory for Unmodified Debitage

Raw Material	Primary		Secondary		Tertiary		Thinning		Totals	
	#	%	#	%	#	%	#	%	#	%
KRF	29	1.0	158	5.9	2359	87.1	163	6.0	2709	100
Chalcedony	3	2.9	6	1.6	331	92.5	18	5.0	358	100
Grey Porcellanite	1	1.7	4	6.8	51	86.4	3	5.1	59	100
Chert	2	5.0	10	25.0	27	67.5	1	2.5	40	100
Obsidian	--	--	4	8.9	41	91.1	--	--	45	100
Petrified Wood	4	30.8	8	61.5	1	7.7	--	--	13	100
Red Porcellanite	--	--	--	--	1	100.0	--	--	1	100
Totals	39	1.0	190	6.0	2811	87.0	185	6.0	3225	100

Table 11

Summary of Debitage By
Flake Size and Weight
By Raw Material

Group Size (mm)	KRF Wt (g)	Grey Porcellanite Wt (g)	Chalcedony Wt (g)	Chert Wt (g)	Obsidian Wt (g)	Petrified Wood Wt (g)	Red Porcellanite Wt (g)
0-5	7.3	1.5	0.3	--	0.5	--	--
5-10	95.0	14.1	3.4	2.4	2.4	0.6	--
10-15	134.1	12.9	4.7	4.0	3.1	1.1	--
15-20	108.9	4.4	1.1	2.6	1.6	1.8	0.4
20-25	56.0	0.5	--	4.2	--	--	--
25-30	26.2	3.2	3.3	7.6	--	4.5	--
30-35	6.2	--	--	--	--	7.4	--
35-40	--	--	--	--	--	--	--
40-45	5.1	--	--	--	--	14.3	--
45-50	--	--	--	--	--	15.7	--
Totals	438.9	36.6	12.8	20.8	7.6	45.4	0.4

562.5

Table 12

Summary of Unmodified Debitage By
Method of Manufacture

Load Application	Primary		Secondary		Tertiary		Thinning		Totals	
	#	%	#	%	#	%	#	%	#	%
Hard hammer percussion	8	22.9	8	22.9	16	45.7	3	8.5	35	100
Soft hammer percussion	5	1.4	30	8.0	156	41.8	182	48.8	373	100
Direct pressure	--	--	--	--	913	100.0	--	--	913	100
<u>Unknown</u>	<u>26</u>	<u>1.4</u>	<u>152</u>	<u>8.0</u>	<u>1726</u>	<u>90.6</u>	<u>--</u>	<u>--</u>	<u>1904</u>	<u>100</u>
Total	39	1.2	190	5.9	2811	87.2	185	5.7	3225	100

An attempt to ascertain the load application for mode of manufacture is presented in Table 12. Means of production were not identifiable for 1,940 (59 percent) of the flakes. Of those identified, only 35 (1.1 percent) were classifiable as hard hammer percussion manufacture. Of these, 22.9 percent (N=8) were primary flakes, 22.9 percent (N=8) were secondary flakes, 45.8 percent (N=16) were tertiary, and 8.5 percent (N=3) were thinning flakes. A total of 11.6 percent (N=373) were classed as soft hammer percussion manufacture. Of these, 1.4 percent (N=5) were primary, 8.0 percent (N=30) were secondary flakes, 41.8 percent (N=182) were thinning flakes. Direct pressure was identified as the mode of manufacture for 28.3 percent (N=913) of the flakes, all tertiary.

Analysis and Summary

Of the flaked stone artifacts (Table 13) recovered from the 4 x 4 meter excavation, one, a projectile point base recovered from Feature 1 (Figure 15a) and defined as a Besant type, is temporally diagnostic. Besant is a distinctive type consisting of large side-notched and a few corner-notched variety dart points originally defined at the Mortlach site in the Besant Valley of Saskatchewan (Wettlaufer 1955). Accepted obsidian hydration dates for this cultural component range from 2041 \pm 124 to 2006 \pm 52 B.P. (Appendices 7.1, 7.2).

Associated with the stone tools are the remains of two distinct features. Feature 1 is the remains of a small hearth characterized by a fire-reddened, oxydized layer of in situ burned earth. Approximately 80 cm north of this feature is a large rock roasting pit with a scatter of smaller fired rock fragments. Directly associated with the features are both burned and unburned bone fragments of bison, and large and small unidentifiable mammals. The direct association of bone with the features suggests the preparation of food, as does the small size of the fragments, which possibly represent the results of bone grease or soup manufacture (Vehik 1977).

Also associated with this level are three small stains with concentrations of lithics and bone debris. These features consist of amorphous stains of fire-reddened earth, small amounts of bone, and a dramatic relative increased density of lithic debris (some burned). These stains appear to represent hearth cleaning activities and dump areas, suggesting that the site was occupied for an extended period.

Table 13

Summary of Total Cultural Artifacts
Collected -- Level 1 0N 3S 1E 2W

Patterned Tools	Projectile Points corner notched base	1
	Preform/Biface Fragment	1
	Endscraper	1
	Drill	1
	Blanks	2
	Bifacial Tips	1
	Bifacial Lateral Edge Fragments	3
Unpatterned Tools	Retouched Flake - Bifacial	1
	Utilized Flakes	11
	Unmodified, Non-utilized Debitage	<u>3225</u>
	Grand Total	<u><u>3247</u></u>

Hearths, roasting pits, hearth cleaning activities, and large amounts of flaked stone debris would be expected to be associated with a base camp of some duration, possibly several weeks. However, the amounts of bone and flaked stone present are actually relatively low for an extended occupation.

Stone flaking for the manufacture and maintenance of tools was a major activity at the site and is concentrated around Feature 7 and the southern portion of the excavated block. The latter stages of manufacture and maintenance were the major activities rather than the entire sequence of lithic reduction. Cores are absent from the site assemblage, and primary and secondary flakes total only 7 percent of the entire assemblage. The majority of the flakes, 87 percent, are tertiary, and 6 percent are thinning flakes.

Most of the flakes, 89.5 percent, are under 15 mm maximum dimension, with 66.25 percent measuring less than 10 mm in dimension. The identification of direct pressure and soft hammer modes as the primary means of manufacture supports this hypothesis. Fifty-nine percent of the flakes were not identifiable as to mode of application of load. Of the remainder, 28.3 percent were produced by direct pressure and 11.6 percent by soft hammer percussion. Only 1.1 percent were hard hammer flakes.

The dominance of small, tertiary, pressure flaked debris is highly suggestive of the final stages of manufacture and/or retouch and maintenance of existing tools. A significant amount of this appears to be due to manufacture. Manufacture is strongly suggested by the numerous blanks and bifacial fragments that appear to have been broken during production, and by the presence of thinning flakes. Few finished tools that bear evidence of heavy use and repair were present in the collection. However, it is highly likely that tools were used and repaired. It is also likely that these tools and most of those manufactured at the site were taken from the site at the end of the stay. The activities carried out at the site did not lead to heavy attrition and discard of existing tools.

The overwhelmingly dominant raw material for all tools and debitage is KRF (82 percent of patterned tools, 92 percent of unpatterned tools, and 0.84 percent of the total debitage). The statement must, however, be qualified. All brown, translucent chalcedony raw materials were

classified as KRF except where definite grains present indicated that the material was actually petrified wood. Thirteen artifacts (0.4 percent of the total debitage) were identified as petrified wood. Of these, 12 were either primary or secondary flakes exhibiting cortical, wood grain textures. However, the interiors of the nodules did not exhibit evidence of wood grain and were identical to those of KRF. This suggests that a portion of the KRF category may well be petrified wood, undistinguishable from the KRF except where cortex is observable.

4.1.4 Block Excavations South of Road

This 4 x 4 meter excavation unit (Plates 2 and 5) was placed south of the current Abraxas access road and south of the UNDAR-West 1981 productive tests. Exact placement was determined from the shovel probe phase of the testing. Shovel Probe 109 of the third transect across the central site area south of Transect 1 produced two flakes: one each of KRF and porcellanite and two pieces of possible fire-cracked rock. Subsequently, formal 1 x 1 meter excavation Unit 35S 5W was placed over this probe. Evidence of three levels appeared: a possible cultural horizon from the upper sod zone; a cultural horizon within the buried paleosol; and a third cultural horizon located five-six cm beneath the paleosol, consisting of bone and flakes in what seemed to be a second paleosol. This area was then expanded into a 3 x 3 meter unit to define the extent and nature of the cultural horizons. The completed 3 x 3 meter block comprised Units 34-36S 3-5W (Map 1). The completed 3 x 3 meter unit exposed a portion of a fire hearth, Feature 5, in the southeast corner, which necessitated expansion of the unit to the east and south. Units 36S 2W, 37S 2W, and 37S 3W were then excavated to define the lateral extent of this feature (Plate 5).

Continued testing of formal 1 x 1 meter units over productive probes exposed an additional feature north of the original 3 x 3 meter unit. Unit 29S 5W was excavated over Shovel Probe 57 of Transect 1 which had produced a single KRF flake. Feature 7 was partially exposed within the northwest corner of this unit and the block was expanded into a 2 x 2 meter unit to define the limit of the feature. The final 2 x 2 meter block excavated comprised Units 28-29S 5-6W. The completion of these units fulfilled the Scope of Work requirement for the completion of a 4 x 4 (16 meter unit) south of the original UNDAR-West tests.

Plate 5



32MZ333 Four-by-four meter area after removal
of Feature 9, facing south

Stratigraphy

The stratigraphy was revealed by the placement of the original shovel probes and further defined by the excavation of Unit 35S 5W. Similar to the profile blocks and to the small Units 11-12N 59-61W, the recent upper zone of light brown sandy loams was 10-12 cm thick and there were no visible dark layers of incipient soil. This unit overlay the dark brown/black paleosol of a former well-developed prairie soil, which was also 10-12 cm deep. The original shovel probe revealed a tan, sandy clay, underlying this unit.

Excavation of Unit 35S 5W revealed an additional horizon five-six cm beneath the base of the first paleosol. This unit was also a dark brown/black loam, five-six cm thick, and was at first believed to be an additional buried paleosol. Continued excavation determined this to be a cultural feature with definable limits, as will be described below. Beneath this horizon was the mottled tan, sandy clay described above, which extends well into sandy subsoil (Figure 16).

Excavation Methodology

Natural stratigraphic units were used in the excavation of the cultural horizons in this area of the site. Level 1 encompassed the level of dark brown, modern sod layer, five-six cm deep. Level 2 comprised the light brown, sandy loam, an additional five-six cm to the top of the buried paleosol. Level 3 was the excavated paleosol, 1-12 cm; Level 4, averaging five-six cm, comprised the lighter brown, mottled zone between the base of the paleosol and Level 5, which is a dark brown/black loam horizon, designated Feature 9. This level is an additional five-six cm deep. Beneath this horizon arbitrary 10 cm levels were excavated to 45 cm, well into sterile subsoil.

Twenty cm thick balk walls were left along the western edge of the Units 33-36S 4W and 33-36S 3W. These balks were left in place to provide a stratigraphic profile and cross-section of Feature 9, and for future reference in the event of further investigation of the central site area of 32MZ333.

Cultural Horizon at Level 1

This level encompassed the modern sod level and is of varying depth, averaging five-six cm. The level produced

evidence of a sparse, intermittent cultural horizon in six of the total of 16 excavated 1 x 1 meter units. The units producing materials in Level 1 are presented in Figure 17.

Nine pieces of flaked stone debitage were recovered from the six excavation units in Level 1, and four lithic materials are represented.

<u>Material</u>	<u>Size (mm)</u>	<u>#</u>	<u>Wt (g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
KRF	10-15	3	0.5	1 thinning	soft hammer
				2 tertiary	unknown
Red por-	10-15	1	0.3	secondary	unknown
cellanite/	15-20	3	1.5	1 secondary	unknown
shale				1 tertiary	soft hammer
				1 tertiary	hard hammer
Chalcedony	10-15	1	0.1	tertiary	unknown
Chert	0-5	1	0.1	tertiary	direct pressure

No other cultural materials were encountered within Level 1 and the remains are too sparse for further cultural comparisons. There is no evidence of a sustained living horizon.

Cultural Horizon at Level 2

This level encompassed the light brown, sandy loams beneath the darker sod level and the surface of the buried paleosol. Again, sparse intermittent evidence of a possible cultural horizon was observed, in this case, from nine of the excavated 1 x 1 meter units (Figure 17). In some cases, the levels were not easily distinguished when digging; therefore, some of the units were excavated too deeply in areas of shallower Level 2 zones.

Eighteen pieces of flaked stone were recovered from Level 2 and four lithic materials are represented. The data is summarized below. One tool, a projectile point midsection, was recovered; the remaining artifacts were classified as debitage.

Biface/Projectile Point Midsection (Figure 22b)

Raw material	KRF
Weight	1.6 g
Length	15.0 mm (broken)
Width	16.0 mm
Thickness	4.5 mm

32 MZ 333

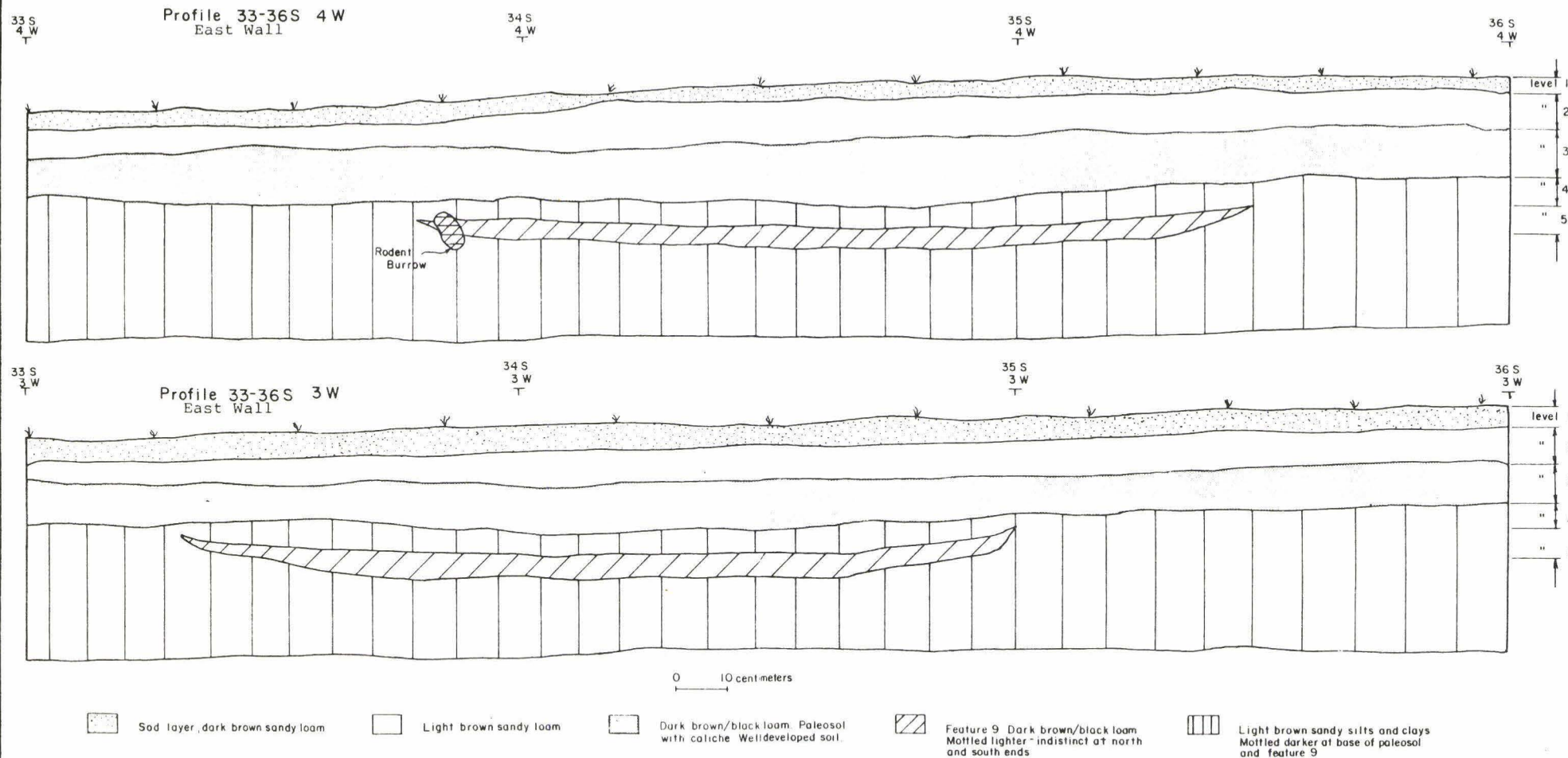
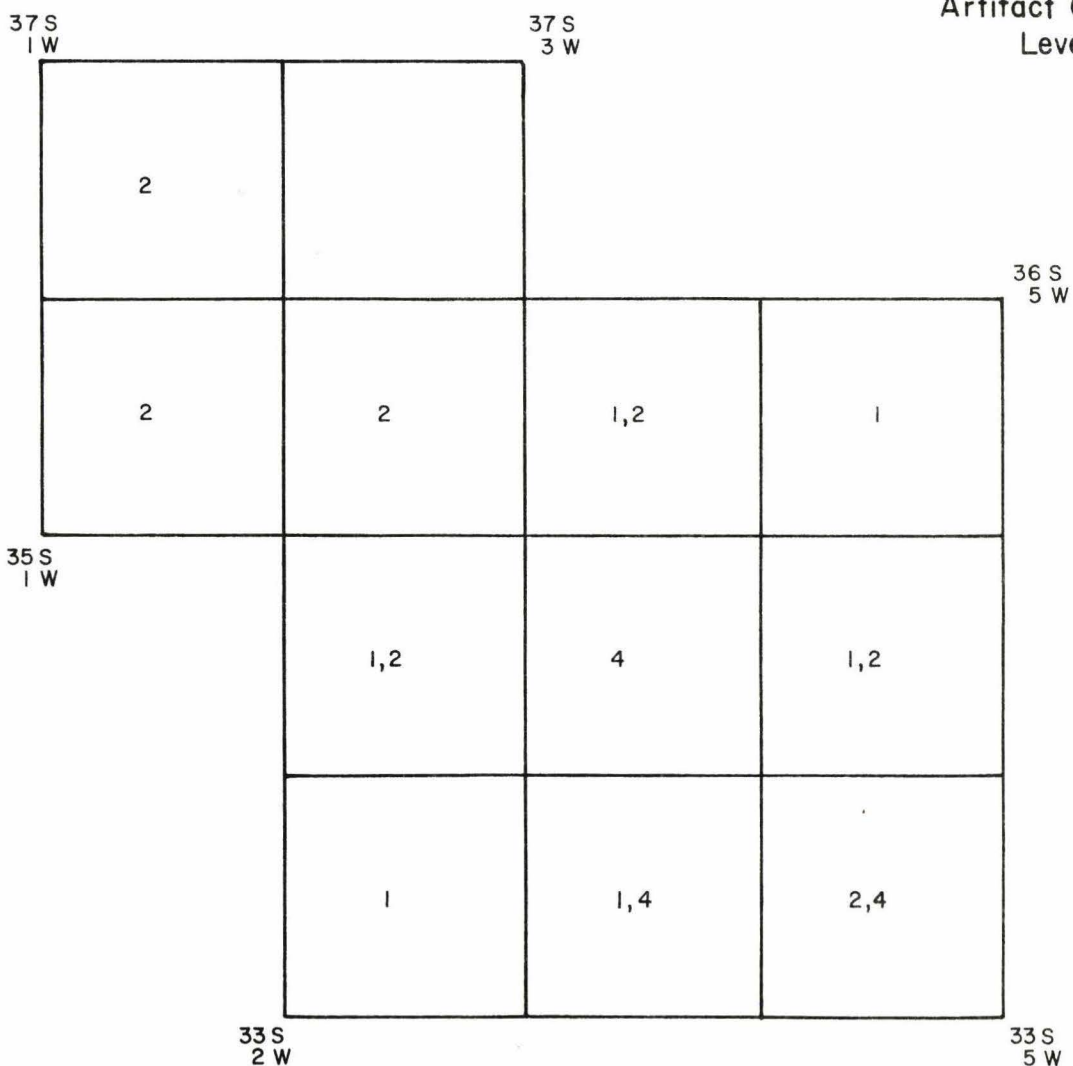


Figure 16

32 MZ 333

Artifact Occurrence
Levels 1,2,4



<input type="checkbox"/>	No cultural material in level 1,2,4			
<input type="checkbox"/>	Cultural material level 1			
<input type="checkbox"/>	"	"	"	2
<input type="checkbox"/>	"	"	"	4
<input type="checkbox"/>	"	"	"	1 and 2
<input type="checkbox"/>	"	"	"	2 and 4
<input type="checkbox"/>	"	"	"	1 and 4

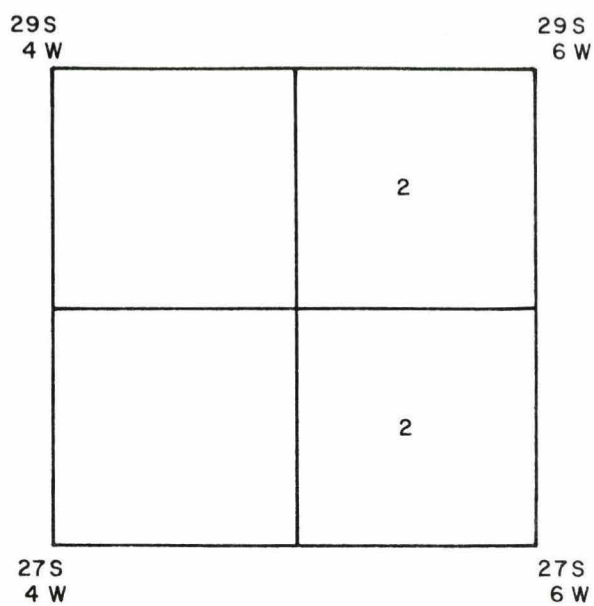


Figure 17

This artifact was recovered from the screen in Unit 29S 6W. It represents the midsection of a medium-sized bi-face with both the tip and basal portions missing and is lenticular in cross-section. The blade is finely flaked with smooth, straight edges. Due to the fine workmanship, size, and lack of diagnostic use-wear, the artifact has been classified as a projectile point midsection. The piece is culturally non-diagnostic.

Debitage

<u>Material</u>	<u>Size (mm)</u>	<u>#</u>	<u>Wt (g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
KRF	5-10	2	0.1	1 tertiary	direct pressure
				1 tertiary	unknown
KRF	10-15	6	2.3	5 tertiary	unknown
				1 tertiary	soft hammer
KRF	20-25	1	0.7	secondary	unknown
KRF	25-30	1	2.4	tertiary	soft hammer
Red por-	5-10	1	0.2	tertiary	unknown
cellanite	10-15	3	1.2	1 tertiary	hard hammer
				1 primary	hard hammer
Red por-				1 primary	unknown
cellanite	15-20	1	0.7	1 primary	unknown
Grey por-	25-30	1	3.3	tertiary	hard hammer
cellanite					
Agate	10-15	1	0.2	tertiary	unknown

No other cultural materials were recovered from Level 2. As in Level 1, there was no indication of a sustained cultural level or living floor. The materials were widely distributed and too sparse for further consideration.

Cultural Horizon at Level 3

This cultural horizon was encountered within the buried paleosol representing a former well-developed prairie soil/sod layer; depth and thickness vary over the site area. The level averages 10-12 cm BGS to 20-22 cm BGS and becomes much shallower to the east. Most of the cultural materials were recovered within the dark brown loam near the lower portion of the level, although artifacts were scattered throughout. The level is characterized by a sparse-to-medium-dense lithic scatter, occasional bone, charcoal flecking, fire-cracked rock, and the presence of fire hearth features and cultural staining of the surrounding matrix.

Features

Three features were encountered in association with the cultural horizon in Level 3. All were present at the base of Level 3 and extended downward into the surrounding light brown matrix of Level 4. Features 5, 7, and 8 represent the remains of shallow, basin-shaped, fire-pit features, described below.

Feature 5. This is a fire hearth found in the extreme southwest corner of the block excavation in Units 36-37S 2-3W. Roughly an elongated oval in shape, the feature measured approximately 55 cm northeast-southwest and 38 cm northwest-southeast. It was encountered at the base of Level 3 at 16 cm BGS and was rather shallow, seven-eight cm deep (Figure 18, Plate 6a).

The upper portion of Feature 5 was indistinct and not well defined until the entire matrix of Level 3 had been removed. The bottom of the level revealed a fairly well-defined feature marked by a distinct fire-reddened, oxidized layer of burned matrix around the edge, a dark fill of ash, occasional charcoal flecking, burned bone, and a few waste flakes. Twenty-one KRF waste flakes were recovered from Feature 5 (3 0-5 mm, 18 5-10 mm), totaling 1.0 g and all evidencing direct pressure removal.

There was no circular ring of hearth stones; three small fire-cracked rock fragments were recovered from the hearth fill. The hearth does evidence excavation of a small pit or depression, six-seven cm deep (Figure 19). The hearth fill was retained for flotation and pollen/floral analysis. No datable material was recovered.

The pollen and floral analysis yielded burned and unburned grass fragments but no evidence of seeds. Scott (1982; Appendix 7.5) suggests that this hearth, like others at the site, may have served for pit-baking of roots using beds of grass as insulation.

Feature 8. Feature 8 represents the remains of a fire hearth located in the southeast corner of the block excavation in Units 37S 2W and 37S 3W, just south of the above-described Feature 5 (Figure 18). The two were originally believed to represent a single large feature. Feature 8 measures 43 cm north-south and 34 cm east-west and is an elongated oval. Encountered at 17 cm BGS, the

feature was rather deep in cross-section, extending 20 cm into Level 4 (Figure 19).

Feature 8 was clearly defined in the course of the removal of the entire surrounding matrix of Level 3 and was distinguished easily from Feature 5. The feature represents a deeply excavated basin in which good evidence is present for in situ burning. The edges of the basin are plainly defined by a distinct red layer of burned and oxidized matrix. The base of the feature is defined by a five cm thick lens of charcoal. Burned bone from Feature 8 included 19 ULM charred bone fragments (6.9 g) as well as five USM charred bone fragments (0.4 g). The west half of the feature fill contained a large KRF end scraper, the only flaked stone. Also contained in the feature fill were 10 fairly large pieces of fired and fire-cracked rock, described below.

1 granite	371.8 g
1 gabbro	349.4 g
1 limestone	414.1 g
1 granite	347.3 g
1 limestone	321.0 g
1 granite	136.1 g
1 gabbro	203.0 g
2 limestone	63.8 g
1 granite	215.1 g

Charcoal from this feature was dated to 1890±65 B.P. (Beta Analytic; Appendix 7.1). The fill contained burned and unburned grass fragments and burned twigs but no seeds. Use of this feature as a pit-baking hearth is suspected (Scott 1982; Appendix 7.5).

Feature 7. Feature 7 also represents the remains of a small basin-shaped, elongated oval, fire hearth. Encountered in the center of Units 28-29S 5-6W, at the base of Level 3 at a depth of 23 cm BGS (Figure 20), it measured 57 cm northeast-southwest and 32 cm northwest-southeast.

The feature consists of a stained area of a darker black matrix and a red, oxidized matrix, containing only minor amounts of charcoal and a fair amount of burned bone. In cross-section, it is plano-convex: flat on the top and convex on the bottom, forming a shallow basin or pit with a maximum depth of only five cm. (Plate 7). The presence of ashy charcoal and fire-reddened earth tends to confirm

32 MZ 333
 Plan View Features 5 & 8
 35-37 S
 1-3 W
 Base of level 3

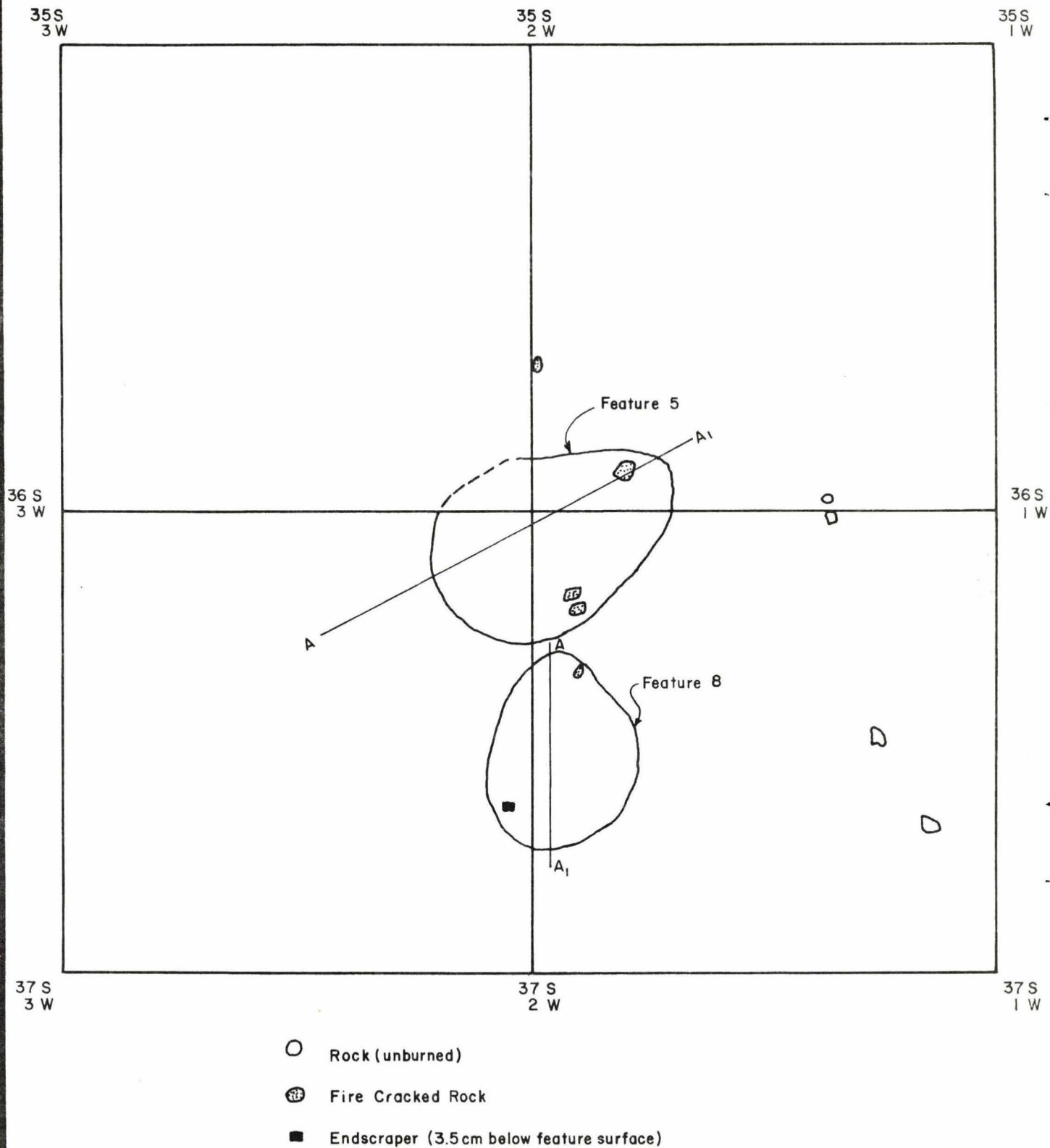
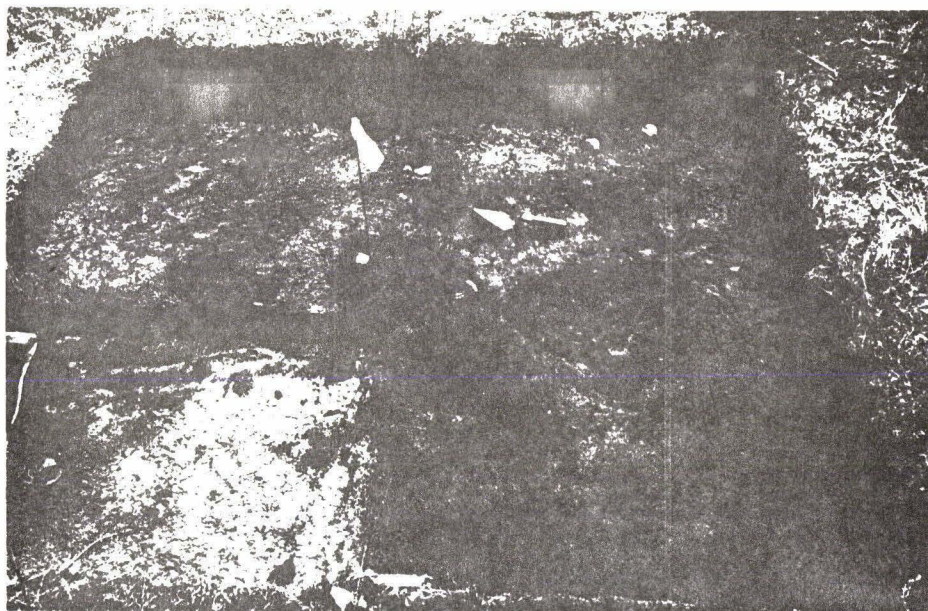
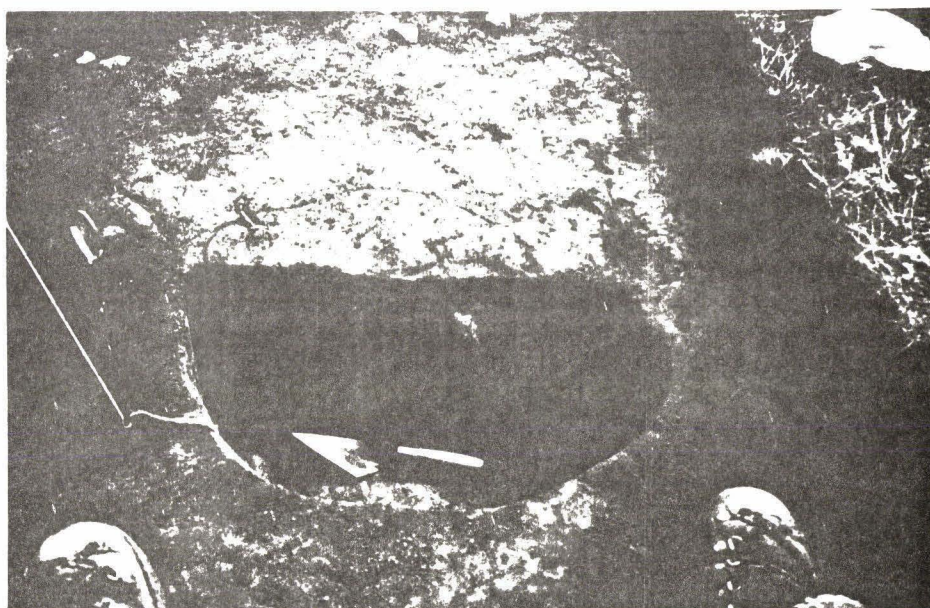


Figure 18

Plate 6



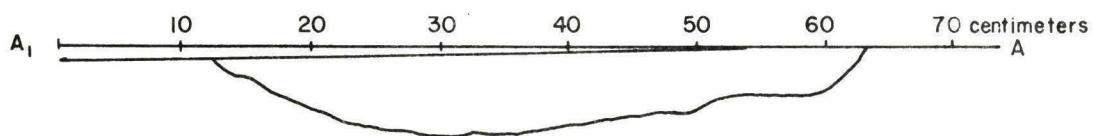
6a. 32MZ333 Features 5 and 8, looking east



6b. 32MZ333 Feature 8 Profile, facing east

32 MZ 333
Profile Drawings
Features 5 & 8

Feature 5



Feature 8

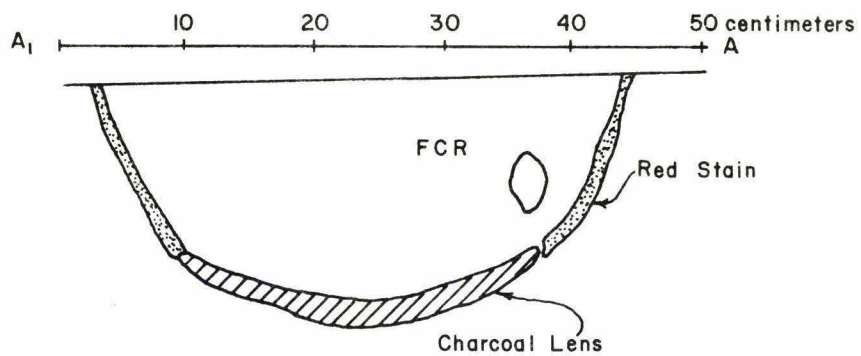


Figure 19

a brief period of in situ burning, possibly as a pit-baking hearth for roots (Appendix 7.5).

The dark fill of Feature 7 contained the following identifiable bone, all charred:

				Wt (g)
	1st phalanx	R distal	Antilocapra	1.3
	2nd phalanx	R whole	"	3.2
	3rd phalanx	R whole	"	1.9
	1st phalanx	L distal	"	2.1
1 foot	1st phalanx	L proximal	"	0.6
	2nd phalanx	L proximal	"	1.0
	2nd phalanx	L distal	"	0.4
	3 phalanx	fragments (3)	"	0.6
	sesamoids	(2)	"	0.5
	TOTAL			12.6

The feature also contained 10 ULM fragments weighing 1.5 g and one KRF flake was recovered.

Material Distribution

Only 155 pieces of flaked stone were recovered from the excavations in the cultural horizon of Level 3 in the block units south of the road (Figure 21). Of these, eight (5.2 percent) were classified as stone tools: seven patterned (87.5 percent), and one unpatterned (12.5 percent). In addition, several previously described charred and burned bone fragments were recovered from the features.

The relatively sparse amounts of bone fragments recovered were all located in and around the fire hearth features; the material was not scattered throughout the level and living floors.

The material distribution of flaked stone will be considered as two separate areas. The large 12-meter block farthest south of the road will be considered as one unit, based upon the close proximity of Features 5 and 8. The contemporaneity of the features has not been absolutely established but they are stratigraphically related and the associated lithics cannot be distinguished. Feature 7 will be considered as a distinct occupation area as it lies nine meters south and three meters west of the other recorded features. The flaked stone and bone fragments surrounding this feature are readily distinguishable.

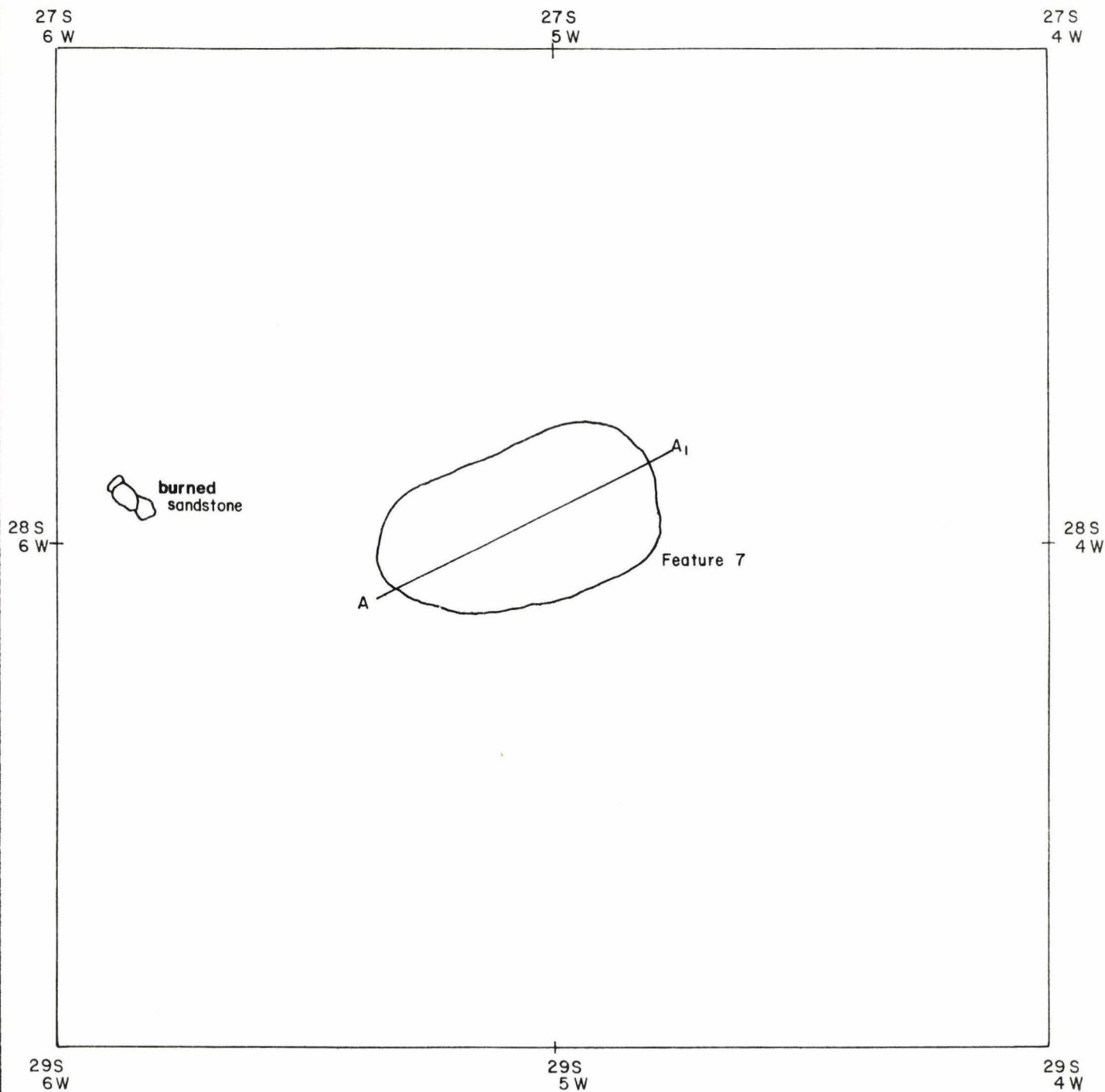
Figure 20

32 MZ 333

Units 27-29S 5-6W

Feature 7

Plan View Level 3

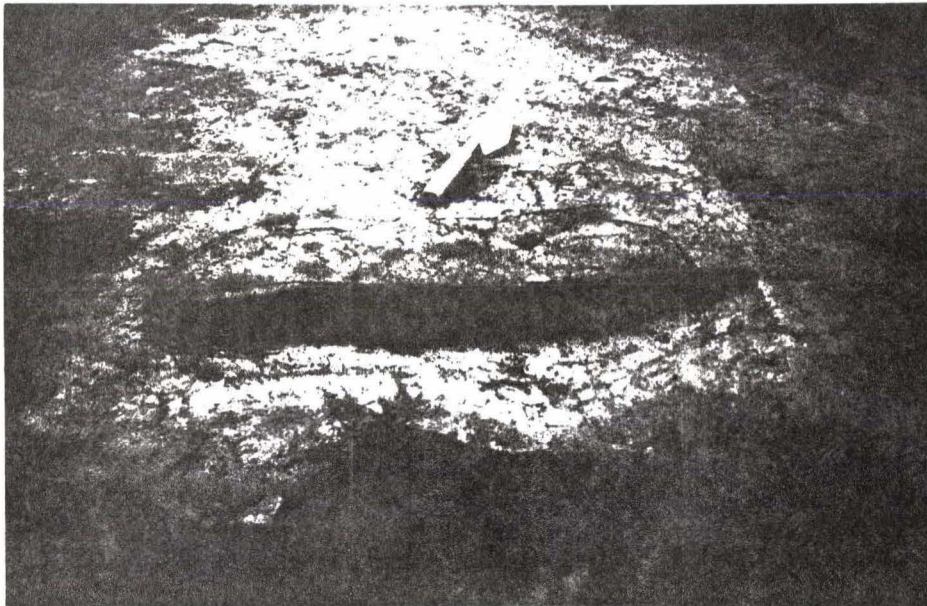


Profile View



0 25centimeters

Plate 7



32MZ333 Feature 7 profile

For both areas, the scatter over the entire living floor of the cultural horizon is very sparse (Figure 21). The larger block associated with Features 5 and 8 contained only 120 pieces of flaked stone: four tools and 116 debitage pieces. The tools seem to be closely associated with the features. An endscraper was recovered from Unit 37S 3W, just west of Feature 8. A second endscraper, the only artifact from that square, was recovered in 35S 3W and a core was recovered from Unit 36S 4W. However, the density of debitage is low surrounding the features. The highest density of debitage occurred in Unit 35S 5W, three meters west and two meters south of the features, followed by Units 36S 4W and 36S 5W. Surrounding the features, the highest concentration occurred in the Feature 5 fill and the unit to the southwest, 37S 3W. Outside these concentration areas the density dropped to less than 10 artifacts per meter squared.

Surrounding Feature 7, one biface/point tip and an endscraper were recovered from 29S 4W and one biface/point base was recovered from 28S 5W. All tools were in the immediate vicinity of the feature. The heaviest debitage concentration occurred to the southeast in Unit 29S 5W with the next highest concentrations to the west. Four tools and 31 debitage fragments were recovered. However, the concentration is misleading in that the only excavated portion of the occupation area surrounding Feature 7 is the 2 x 2 meter unit immediately adjacent, which may distort the apparent artifact density.

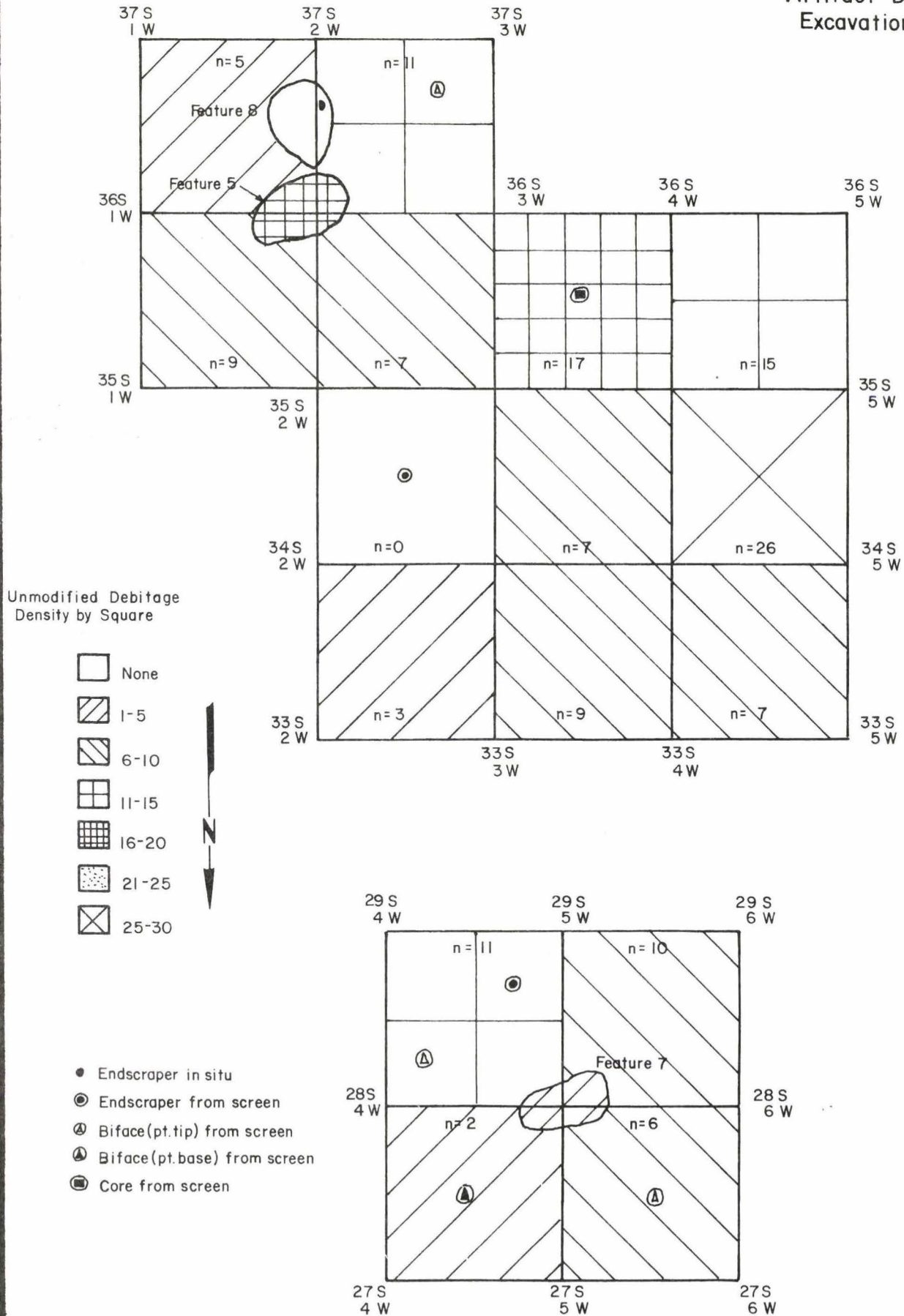
It seems clear that the major tool use areas were nearby, as this is where the observed tools were concentrated. Remains of debitage are low adjacent to Features 5 and 8 with higher concentrations some distance northwest. From the available data, both tool use and lithic reduction occurred in the vicinity of Feature 7, although only a small portion of the living floor was excavated.

Artifact Descriptions

Of the 155 flaked stone artifacts, only eight (5.2 percent) were classifiable as tools. Seven of these (87.5 percent) were patterned tools and one (12.5 percent) was unpatterned. The remaining 147 artifacts were classified as debitage.

Figure 21

32 MZ 333
Artifact Distributions
Excavation Level 3



Patterned Tools

Projectile point (Figure 22a)

Raw material	KRF
Weight	2.6 g
Length	32.0 mm
Width	16.0 mm
Thickness	5.0 mm
Blade Length	24.5 mm
Neck width	11.5 mm
Stem length	6.0 mm
Notch width	4.0 mm
Notch depth	2.0 mm
Base width	15.0 mm

This artifact was recovered from screening the shavings along balk wall 34-36S 3W; therefore, the exact provenience and level association are unknown. The article is a fairly large, side-notched, triangular projectile point. The blade edges are straight and smooth from irregular pressure flaking, show evidence of sharpening and reworking, and are slightly beveled. The shoulders are tapered to an expanding stem. The stem/base juncture is an acute rounded angle; the base is straight to slightly concave. The point has not been classified as to type, and its relationship to Cultural Horizon 3 is unclear.

Projectile Point/Preform (Figure 22c)

Raw material	KRF
Weight	0.7 g
Length	20.0 mm
Width	15.0 mm
Thickness	2.5 mm

The tip of this artifact was recovered from 29S 5W and the base from 28S 5W in the vicinity of Feature 7. It is a small triangular, unnotched biface, typical of unnotched projectile points of the Late Prehistoric period, and could also represent a preform prior to notching. Lenticular in cross-section and finely pressure flaked, the base has been carefully thinned; the edges are fairly straight with slight constrictions at the basal end. The artifact exhibits no use-wear and may have been broken during manufacture.



a



b



c

Figure 22

Biface/Point Tip

Raw material	KRF
Weight	0.2 g
Length	5.0 mm (broken)
Width	8.0 mm (broken)
Thickness	2.5 mm

This artifact from Unit 37S 3W was recovered in the screen and represents a very small tip from what appears to be a triangular biface or projectile point. The artifact is bi-convex in cross-section, finely pressure flaked, and associated with Feature 8.

Bifacially Retouched Flake

Raw material	Grey porcellanite
Weight	4.1 g
Length	31.0 mm
Width	22.0 mm
Thickness	5.5 mm

This artifact was recovered from Unit 28S 6W in screening. It was manufactured on a large tertiary flake that was bifacially altered in the early stages of initial edging. The piece is lenticular in cross-section and roughly triangular in outline, and shows evidence of direct percussion as well as possible pressure flaking. The artifact appears to have been broken during manufacture.

Endscraper (Figure 23a)

Raw material	KRF
Weight	6.7 g
Length	31.0 mm
Width	22.5 mm
Thickness	7.0 mm
Length retouched edge	32.0 mm

This tool, recovered from Unit 29S 5W in the vicinity of Feature 7, was manufactured on a large tertiary flake with a plano-convex cross-section. Steep distal retouch is evident as well as marked utilization on the lateral edges. The utilized edges show marked step flaking and edge rounding.

Endscraper (Figure 23b)

Raw material	KRF
Weight	2.8 g
Length	23.0 mm
Width	20.0 mm
Thickness	4.5 mm
Length retouched edge	21.0 mm

Recovered from screening in Unit 35S 3W, the scraper was manufactured from a small secondary flake by steep distal retouch. The cross-section is plano-convex and the left lateral edge exhibits some evidence of retouch and utilization; the right lateral side has been used. Use-wear consists of step flaking and edge rounding to the working edge.

Endscraper (Figure 23c)

Raw material	KRF
Weight	9.6 g
Length	32.0 mm
Width	28.0 mm
Thickness	10.0 mm
Length retouched edge	41.0 mm

The endscraper was recovered from the fill of Feature 8 and was manufactured from a large secondary flake, plano-convex in cross-section. Steep distal retouch extends across the distal edge and 10 mm along the right lateral edge. The utilized edge is heavily step-flaked with use-wear scars along the entire right lateral edge.

Core

Raw material	Petrified wood
Weight	19.7 g
Length	39.0 mm
Width	21.5 mm
Thickness	16.0 mm

Recovered from Unit 36S 4W, the core was manufactured from a small nodule of siliceous petrified wood. One side exhibits cortex on 75 percent of the surface. It is non-bipolar and bi-directional, with evidence of removal of multiple flakes.



a



b



c

Figure 23

<u>Unpatterned Tools</u>	
<u>Utilized flake</u>	
Raw material	KRF
Weight	10.0 g
Length	49.0 mm
Width	23.0 mm
Thickness	8.0 mm

This flake was recovered from Unit 28S 6W in the vicinity of Feature 7. It represents a large secondary flake with cortex on the distal end and a portion of the right lateral edge only, and is plano-convex in cross-section. Evidence of use-wear exists on the cortical distal edge as small step fractures at right angles to the edge, and on the lateral edges by small feather-terminated micro-flakes that appear to be at angles to the edge. Use-wear suggests that the tool was employed in cutting and scraping.

Of the patterned tools, 71.4 percent (N=5) are KRF, 14.3 percent (N=1) are petrified wood, and the same number are grey porcellanite. The single unpatterned tool is of Knife River Flint. Of the total, 75 percent are KRF, 12.5 percent are grey porcellanite, and 12.5 percent are petrified wood.

Debitage

One hundred forty-seven pieces of flaked stone debitage were recorded from the units excavated at Level 3: 116 from the large southern block in the vicinity of Features 5 and 8, and 31 from Units 28-29S 5-6W in the vicinity of Feature 7. These will be discussed separately. The data are summarized in Tables 14 to 21.

Eight lithic materials came from the large block. KRF represents 85.3 percent (N=99), chert, 6 percent (N=7); grey porcellanite, 3.4 percent (N=4); chalcedony, 2.6 percent (N=3); and TRSS, red porcellanite, and quartzite represent 0.9 percent each (N=1) (see Table 14).

The largest flake class is tertiary (69.8 percent or N=81), followed by secondary flakes (19.8 percent or N=23), thinning flakes (6.9 percent or N=8), and primary flakes (3.4 percent or N=4) (see Table 15). The flake size distribution shows that most of the flakes are relatively large (Table 14). Only 28 flakes (23.1 percent) are smaller than 10 mm in maximum dimension. However, 46.6 percent (N=54) are between 10 and 15 mm. The remaining 34 flakes (30.3 percent) vary in size between 15 and 75 mm.

The mode of production is presented in Table 16. The majority, 62.9 percent (N=73), were not identifiable. Of those identified, only 3.4 percent (N=4) were hard hammer flakes; 50 percent were primary flakes and 25 percent were secondary or tertiary. Identified soft hammer flakes represent 18.1 percent with 23.8 percent (N=5) being secondary, 38.1 percent (N=8) tertiary, and 38.1 percent (N=8) thinning flakes. Direct pressure was identified on 18 flakes, all tertiary flakes.

Six lithic materials were represented in the vicinity of Feature 7: KRF (48.4 percent, N=15); grey chalcedony (32.3 percent, N=10); red porcellanite (9.7 percent, N=3); obsidian, TRSS, and a distinctive green chalcedony not observed in other collections (3.2 percent, N=1 each); see Table 18.

Tertiary flakes represented the overwhelming majority with 87.1 percent (N=27), but secondary flakes comprised the remaining 12.9 percent (N=4). No primary or thinning flakes were identified (Table 19).

Flake sizes were relatively large with 87.1 percent between 5 and 20 mm in maximum dimension. The remaining 12.9 percent were between 20 and 35 mm (Table 18).

Of the flakes present, 61.3 percent (N=19), were unidentifiable as to means of production. Secondary, hard hammer flakes equaled 3.2 percent (N=1), and 29 percent (N=9) were soft hammer flakes, of which one was secondary (11.1 percent), and eight were tertiary (8.9 percent). Two flakes were direct pressure, tertiary flakes, 6.4 percent of the total (Table 20).

Analysis and Discussion

All of the features and materials encountered were within or at the base of the Level 3 dark paleosol. Three dates have been obtained from radiocarbon and obsidian samples at Features 7 and 8. Feature 7 yielded a carbon date of 2020 ± 70 B.P. and an obsidian date of 1954 ± 87 B.P.; Feature 8 had a carbon date of 1890 ± 65 B.P. (Beta Analytic, Appendix 7.1; MOHLAB, Appendix 7.2). No diagnostic artifacts were recovered in direct association with the cultural horizon. Only the untyped side-notched projectile point can be considered complete enough for typing, but it is not considered here as its association with Level 3 has not been confirmed.

Table 14

Lithic Materials from 4 x 4 m Unit
South of Road, Level 3

Size (mm)	KRF	Chalcedony	Grey Porcellanite	Chert	TRSS	Red Porcellanite	Obsidian	Quartzite	Totals	%
0-5	2	--	--	1	--	--	--	--	3	2.6
5-10	21	--	--	4	--	--	--	--	25	21.5
10-15	45	3	2	2	1	1	--	--	54	46.6
15-20	20	--	--	--	--	--	--	--	20	17.2
20-25	6	--	--	--	--	--	--	--	6	5.2
25-30	--	--	--	--	--	--	--	--	--	--
30-35	3	--	2	--	--	--	--	--	5	4.3
35-40	2	--	--	--	--	--	--	--	2	1.7
70-75	--	--	--	--	--	--	--	1	1	0.9
Totals	99	3	4	7	1	1	0	1	116	100
%	85.3	2.6	3.4	6.0	0.9	0.9	0	0.9	100	

Table 15

Flake Category by Material Type
4 x 4 m Unit South of Road, Level 3

<u>Raw Material</u>	<u>Primary</u>	<u>Secondary</u>	<u>Tertiary</u>	<u>Thinning</u>	<u>Total</u>	
					#	%
KRF	3	20	68	8	99	85.3
Chalcedony	--	1	2	--	3	2.6
Grey por- cellanite	--	2	2	--	4	3.4
Chert	--	--	7	--	7	6.0
TRSS	--	--	1	--	1	0.9
Red por- cellanite	--	--	1	--	1	0.9
Obsidian	--	--	--	--	--	--
Quartzite	1	--	--	--	1	0.9
Totals	4	23	81	8	116	
%	3.4	19.8	69.8	6.9		100.0

Table 16

Flake Category by Load Application
4 x 4 M Unit South of Road, Level 3

Load Application	Primary		Secondary		Tertiary		Thinning		Total	
	#	%	#	%	#	%	#	%	#	%
Hard hammer	2	50.0	1	25.0	1	25.0	--	--	4	3.4
Soft hammer	--	--	5	23.8	8	38.1	8	38.1	21	18.1
Direct pressure	--	--	--	--	18	100.0	--	--	18	15.5
Unknown	2	2.7	17	23.3	54	74.0	--	--	73	62.9
Totals	4	52.7	23	2.1	81	237.1	8	38.1	116	100.0

Table 17

Material Types by Weight (g)
4 x 4 m Unit South of Road

Size (mm)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)
	KRF	Chalcedony	Grey Porcellanite	Chert	TRSS	Red Porcellanite	Obsidian	Quartzite	Totals
0-5	0.2	--	--	0.1	--	--	--	--	0.3
5-10	1.8	--	--	0.3	--	--	--	--	2.1
10-15	11.3	0.5	1.9	0.5	0.2	0.2	--	--	14.6
15-20	15.1	--	--	--	--	--	--	--	15.1
20-25	10.1	--	--	--	--	--	--	--	10.1
25-30	--	--	--	--	--	--	--	--	--
30-35	10.2	--	6.6	--	--	--	--	--	16.0
35-40	10.9	--	--	--	--	--	--	--	10.9
70-75	--	--	--	--	--	--	--	48.8	48.8
Totals (g)	59.6	0.5	8.5	0.9	0.2	0.2	--	48.8	118.7

Table 18

Lithic Materials
Units 28-29S 5-6W Feature 7, Level 3

Size (mm)	KRF	Grey Porcellanite	Red Porcellanite	Green Chalcedony	TRSS	Obsidian	Total	
							#	%
0-5	--	--	--	--	--	--	--	--
5-10	4	2	--	--	1	--	7	22.6
10-15	5	6	--	--	--	1	12	38.7
15-20	5	1	2	--	--	--	8	25.8
20-25	--	1	1	1	--	--	3	9.7
25-30	--	--	--	--	--	--	--	--
30-35	1	--	--	--	--	--	1	3.2
Totals	15	10	3	1	1	1	31	100.0
%	48.4	32.3	9.7	3.2	3.2	3.2	100	

The presence of multiple features over a wide area suggests that the site may have been revisited on a number of occasions over a period of time. None of the occupations were of long duration judging by the small number of lithic artifacts and bones recovered from the sites. A longer occupation would be represented by staining and a much denser occupation layer.

The tools are few but indicate a short-term hunting camp. The sparseness of lithic debris combined with tool types present (scrapers and projectile points) signify functions associated with short-term procurement of available natural resources. This is also suggested by the presence of features representing small hearths with associated bone and burned bone and demonstrating cooking activities.

Bone identified from the features and surrounding areas indicates the presence of both small and large unidentified mammals. Only Feature 7 contained identifiable bones. Twenty-two bones from one antelope foot were recovered. The foot bones are heavily charred.

Knife River Flint is the predominant lithic material present. At the large 4 x 4 meter block south of the road, a wide range of lithic reduction activities is apparent. A core of petrified wood and the presence of primary and secondary flakes suggest the initial reduction of core materials, as does the larger number of large flakes. The presence of thinning and tertiary flakes demonstrates the further reduction of secondary blanks to finished pieces, although on a small scale, as the total debitage numbers are not great. A wide range of lithic reduction techniques are also represented by the presence of all three modes of production: hard hammer for the primary, secondary, and initial core reduction; soft hammer for further reduction and thinning. The final stages of shaping were apparently done by direct pressure. A wide range of tool manufacture/maintenance is suggested, although on a somewhat limited scale.

The area around Feature 7 indicates a more restricted range of lithic reduction. The dominant flake category present is tertiary, and the dominant mode of production is soft hammer. The main lithic reduction centered around KRF, with secondary and tertiary flakes, and grey porcellanite with tertiary flakes and the presence of few pressure flakes indicate little of the final stages of biface

Table 19

Flake Category
Units 28-29S 5-6W Feature 7, Level 3

<u>Raw Materials</u>	Primary		Secondary		Tertiary		Thinning		Totals	
	#	%	#	%	#	%	#	%	#	%
KRF	--	--	3	20.0	12	80.0	--	--	15	48.4
Grey porcellanite	--	--	--	--	10	100.0	--	--	10	32.3
Red porcellanite	--	--	1	33.3	2	66.6	--	--	3	9.7
Green chalcedony	--	--	--	--	1	100.0	--	--	1	3.2
TRSS	--	--	--	--	1	100.0	--	--	1	3.2
Obsidian	--	--	--	--	1	100.0	--	--	1	3.2
Total #	--	--	4	--	27	--	--	--	31	--
Total %	--	--	--	12.9	--	87.1	--	--	--	100.00

Table 20

Mode of Production
Units 28-29S 5-6W, Feature 7, Level 3

Mode of Production	Primary		Secondary		Tertiary		Thinning		Totals	
	#	%	#	%	#	%	#	%	#	%
Hard hammer	--	--	1	100.0	--	--	--	--	1	3.2
Soft hammer	--	--	1	11.1	8	88.9	--	--	9	29.0
Direct pressure	--	--	--	--	2	100.0	--	--	2	6.4
Unknown	--	--	2	10.5	17	89.5	--	--	19	61.3
Totals	--	--	4	12.9	27	87.1	--	--	31	100.0

Table 21

Material Types by Weight (g)
Units 28-29S 5-6W Feature 7, Level 3

Size (mm)	KRF	Grey Porcellanite	Red Porcellanite	Green Chalcedony	TPSS	Obsidian	Totals
0-5	--	--	--	--	--	--	--
5-10	0.5	0.2	--	--	0.3	--	1.0
10-15	1.5	1.6	--	--	--	0.4	3.5
15-20	2.6	0.6	2.7	--	--	--	5.9
20-25	--	1.7	1.0	0.6	--	--	3.3
25-30	--	--	--	--	--	--	2.3
30-35	2.3	--	--	--	--	--	--
Totals	6.9	4.1	3.7	0.6	0.3	0.4	16.0

manufacture/maintenance. Of particular interest is the wide range of lithic resources (obsidian, green chalcedony, TRSS) present in the assemblage with only one flake each. A wider area of excavation surrounding this feature will be necessary to fully understand the activities and tasks undertaken here.

Cultural Horizon at Level 4

This level encompassed the light brown, slightly mottled zone between the base of Level 3 and the surface of Level 5 Feature 9, and averaged five-six cm. The level produced sparse, intermittent artifacts in three of the 16 units excavated. The units with materials present are displayed in Figure 17. Three lithic artifacts, presented below, were recovered from this level.

<u>Material</u>	<u>Size (mm)</u>	<u>#</u>	<u>Wt (g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
KRF	10-15	1	0.2	tertiary	unknown
Grey por-cellanite	10-15	1	0.5	tertiary	unknown
Red por-cellanite	15-20	1	1.2	tertiary	hard hammer

The sparse nature of the remains from this level indicates that they may be intrusive, the result of bioturbation from levels above or below. This could not be confirmed by the excavation.

Cultural Horizon at Level 5

This level was first encountered in Unit 35S 5W. At the time, it was believed to represent a buried paleosol underlying the dark paleosol of Level 3. However, as the units were subsequently expanded from 35S 5W and removed to the top of Level 5, it became clear that the dark black loam stain did not represent a paleosol and that it had definite, definable limits. Both walls were left for profile purposes and all surrounding units were excavated to the surface of Level 5 in order to define the lateral limits of the apparent feature. The stain was subsequently labeled Feature 9.

Feature 9 appeared in Units 34-36S 3-5W (see Figure 24), planview). The feature extended 230 cm east-west by 150 cm north-south at an average depth of 32 cm BGS.

Consisting of a dark brown/black loam soil lens in a broad, shallow basin shape, the feature extended five-six cm in depth (see Figure 25, profile, and Figure 16, profile of the whole unit). The surface of the stain was littered randomly with small amounts of bone and lithic debris (see Figure 24, planview). No artifacts were found outside the stained area in any of the excavated units.

The stain was deep black and easily definable. The edges of the feature were a lighter color and somewhat amorphous, but also clearly definable. Other than the associated bone and waste flakes, no cultural materials or features were present.

Artifacts Descriptions

Seven debitage pieces were recovered from the fill of Feature 9. Two types of raw material were present, KRF (N=4 or 57.1 percent) and grey porcellanite (N=3 or 42.9 percent), listed below.

<u>Material</u>	<u>Size (mm)</u>	<u>#</u>	<u>Wt (g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
KRF	15-20	2	1.5	1 tertiary	soft hammer
				1 tertiary	unknown
	20-25	2	2.1	1 tertiary	soft hammer
				1 thinning	soft hammer
Grey por-cellanite	10-15	2	1.0	2 tertiary	unknown
	20-25	1	0.8	1 secondary	unknown

Faunal Analysis

In Unit 35S 4W, 12 ULM bones weighing 3.3 g were recovered. Five ULM fragments (9.9 g) and 34 ULM bones (20.5 g) were found in Unit 35S 5W, while Unit 36S 5W produced 17 ULM bones (8.2 g).

Analysis and Discussion

The exact nature and function of Feature 9 in Level 5 is not clearly understood. The level represents a distinct cultural horizon that was encountered only in Units 33-36S 3-5W and in no other excavation units. Artifacts were recovered only within the dark stain and nowhere else in the surrounding lighter brown matrix. John Albanese suggested the possibility that the stain represents a small

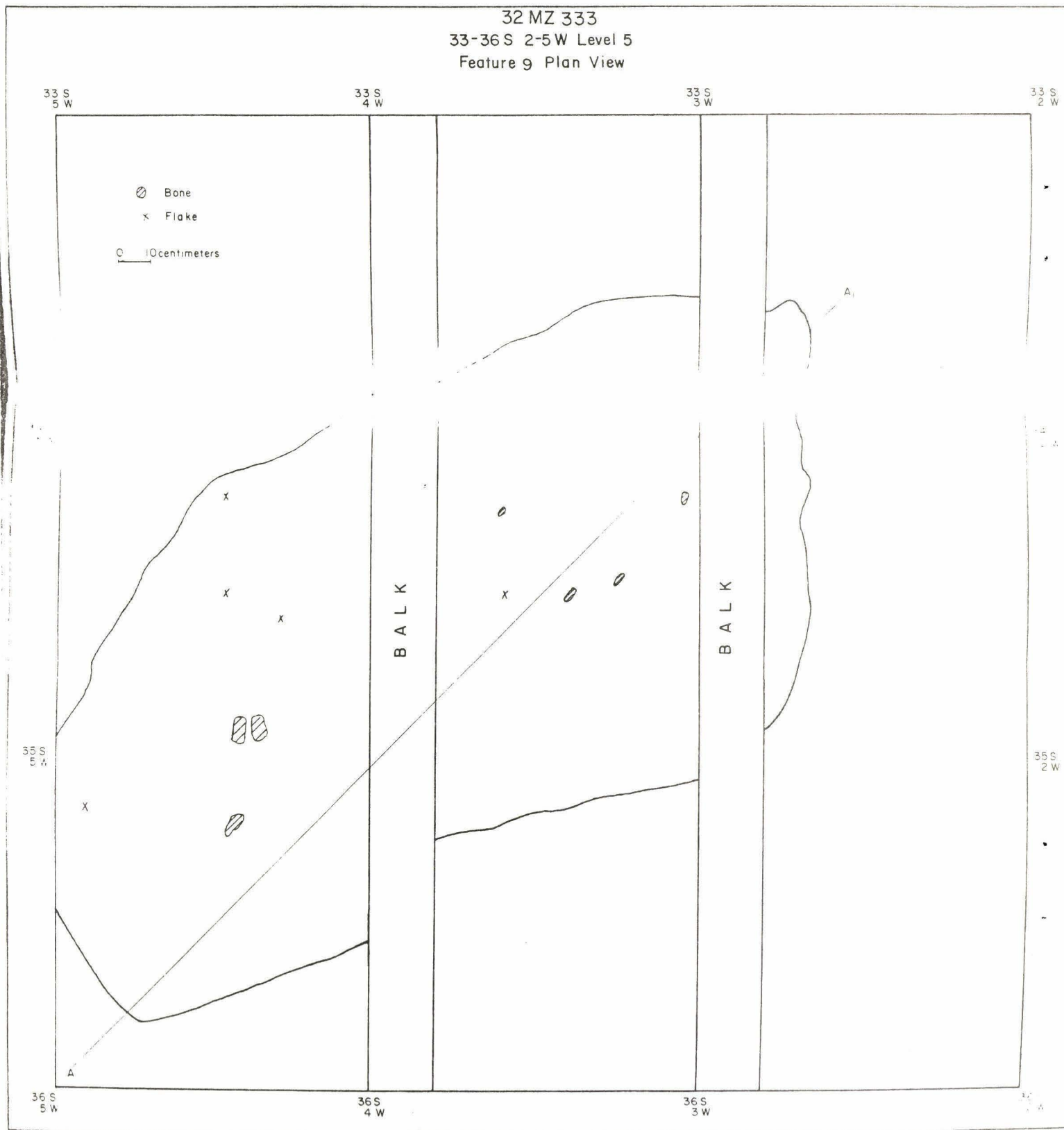
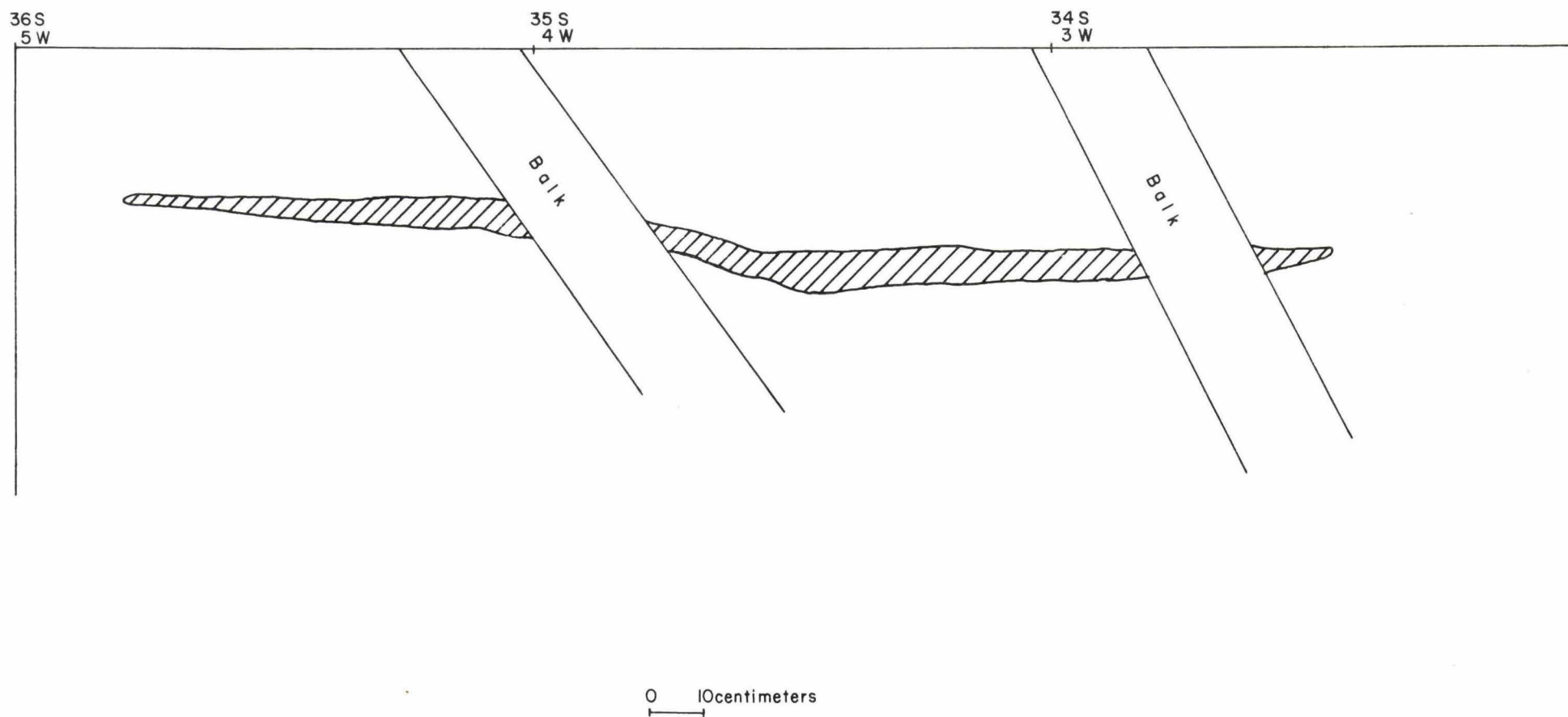


Figure 24

Figure 25

32 MZ 333
Feature 9 Profile
SW-NE



Profile drawn using measurements taken with string level from datum at 36 S 5 W.

swale or depression in which a dark soil (not present over the rest of the site) was developed. This, however, does not explain the presence of cultural materials only within the stain.

The feature appears to be the result of cultural development and staining of the surrounding matrix. It seems feasible that the small stain/depression represents the remnants of a small habitation structure of brush or skins. No postholes were encountered, but this is not unusual if the feature represents a short-term, temporary structure.

Samples of the feature matrix were submitted for dating and pollen analysis. A radiocarbon date of 2270±80 B.P. was obtained (Beta Analytic; Appendix 7.1). The pollen and floral analysis revealed the presence of burned and unburned grass fragments and unburned and partially burned Cheno-am seeds (Scott 1982; see Appendix 7.5).

The sparse nature of the remains present at this level precludes analysis of the cultural activities which generated them.

Cultural Horizon at Level 6

Cultural material was encountered below Feature 9, Level 5 in only one excavation unit. This material, a single artifact, is believed to have been brought down from the cultural horizons above as a result of bioturbation. The artifact recovered is a red porcellanite core from Unit 35S 5W.

Weight	58.6 g
Length	57.5 mm
Width	47.5 mm
Thickness	28.0 mm

The core is non-bipolar, retaining cortex on only one small corner, and is multi-facial and bi-directional.

4.1.5 Profile Cuts

As specified in the USFS Scope of Work for the Abraxas testing, a four-meter section of the eroding cutbank along the western edge of the central site area was excavated and profiled back at least 50 cm. In order to examine and test a larger portion of the site area for cultural

materials, it was decided to excavate two two-meter profile blocks rather than one large four-meter section. The placement of the profile units was ascertained by a close examination of the eroding cutface. Two areas were selected because of the presence of cultural materials, flakes and cracked bones, eroding and visible in the slope-wash west of the site. A two-meter by 50 cm grid was then shot in from the datum for excavation, centered on the probable source area of the observed cultural materials.

Profile Cut 1

The placement of Profile Cut 1 was determined by the presence of four ULM bone fragments and two tooth fragments (probably bison, based upon size) eroding from the cutface near the present ground surface (Plate 8a). Also observed were three grey porcellanite flakes, one pressure tertiary flake (5-10 mm), and two tertiary flakes (10-15 mm), of evident soft hammer percussion manufacture. In addition, one chalcedony tertiary flake (0-5 mm) of unknown load was collected. A two-meter by 50 cm unit was staked over the productive area at 51 to 53 meters south and extending west to the edge of the cutbank from 27.8 meters west of datum (Plate 8b).

Stratigraphy

The cutface to be excavated was then handfaced using shovels and trowels to define the profile stratigraphy. The profile exposure was extremely dry and sun-baked, creating a hard, blocky texture to the soils and making visibility of the profile strata difficult. The excavated profile unit east wall is presented in Figure 26.

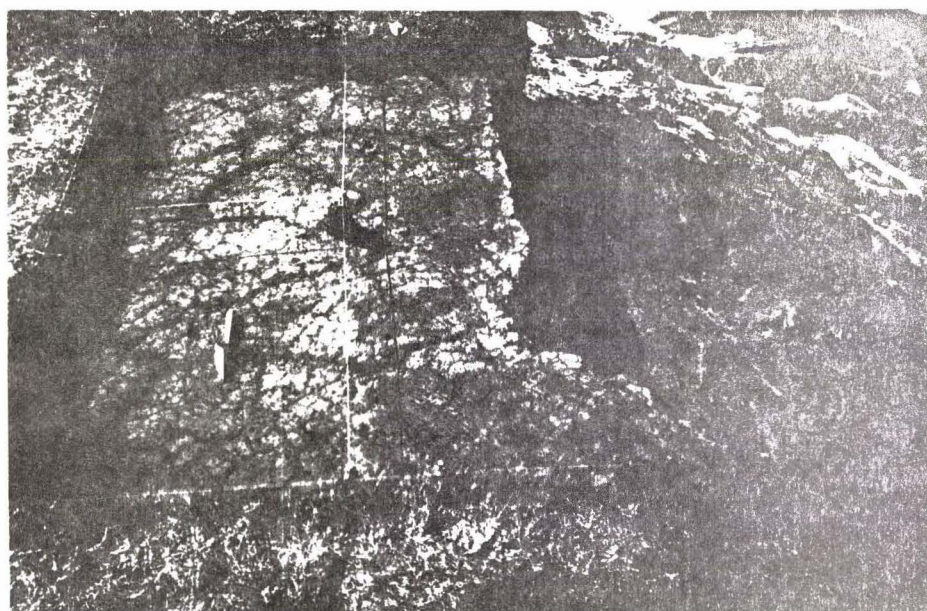
The upper soil zone of light brown sandy loams of recent eolian origin was approximately 20 cm thick at Profile Cut 1. The older, underlying paleosol was approximately 25 cm thick. These two soil zones overlay a sterile sandy clay.

Examination of the cutface profile revealed a series of dark bands representing incipient soil layers present in the upper, more recent, soil. Five of these incipient soils or stabilized periods were visible in the profile. The third soil layer from the surface, approximately eight to 10 cm deep, exhibited a dense, uniform layer of charcoal, cracked bone, and flakes in the visible profile and was assumed to be a cultural level. In addition, a flake

Plate 8



8a. 32MZ333 Eroding, articulated bison bone
in draw, facing west



8b. 32MZ333 Profile Cut 1, Feature 4,
facing south

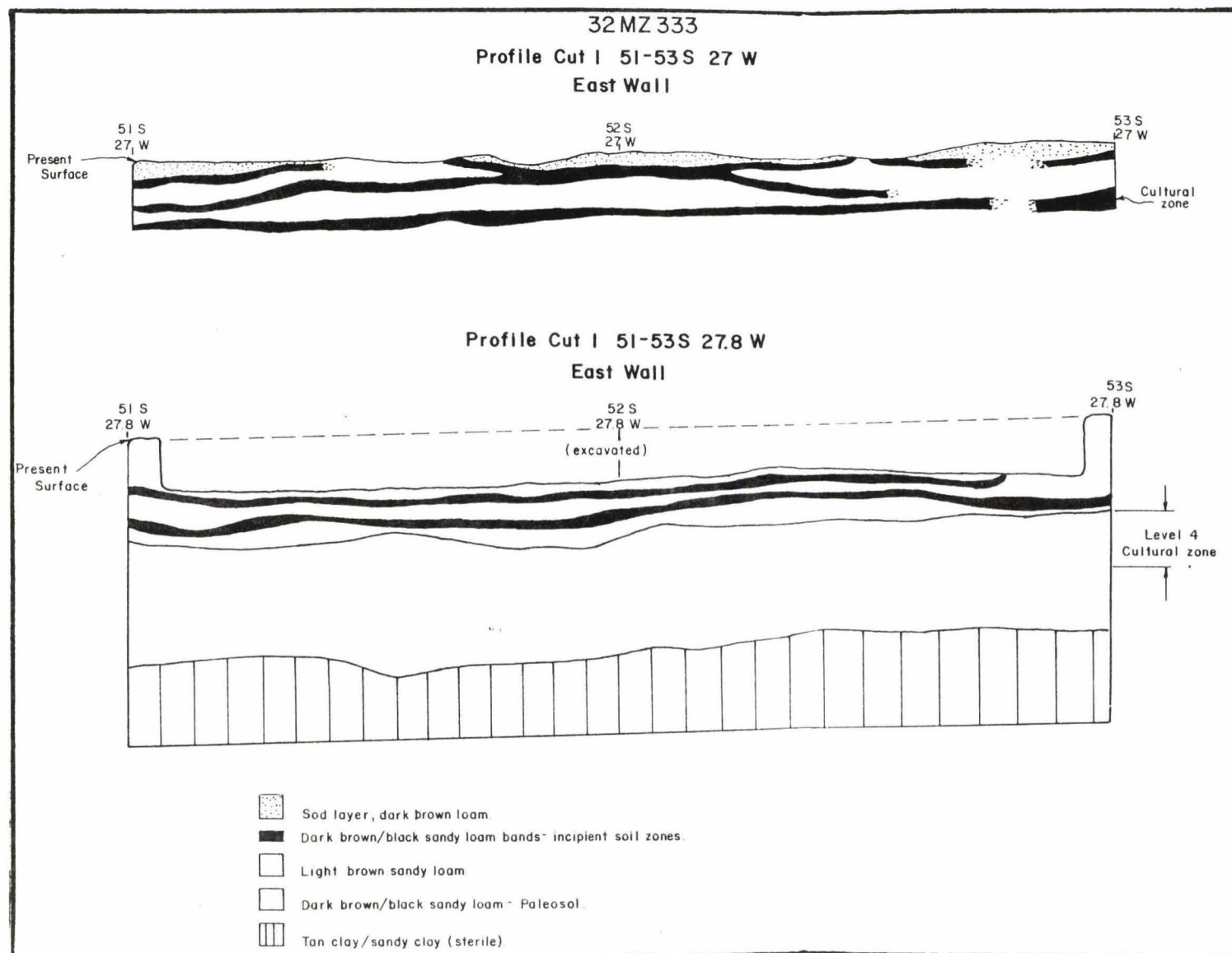


Figure 26

was observed within the older paleosol at approximately 30 cm from the surface, indicating a potential older cultural horizon more deeply buried.

Excavation Methodology

The methodology involved the removal of the sod and troweling down approximately seven to eight cm to the top of the observed cultural layer. The depth of the cultural horizon varied over the units excavated and was easily identified by the presence of bone, flakes, and a dense layer of scattered charcoal. This represented Level 1. Level 2 was then excavated, encompassing the depth of the cultural level to 13-14 cm BGS. All materials in the initial profile cut were associated with Level 2, although there was some mixing of materials in each level.

Excavation of Level 2 revealed a fire hearth feature, Feature 4, at the base of the level. In order to define the feature limits, the block was extended eastward 80 cm to 27 meters west along the entire two-meter cut. These units were excavated in a manner similar to the initial profile cut. The entire unit was then excavated in two levels, well below the cultural horizon. Units 51-53S 27.8W were not excavated below this level; only the original 50 cm profile block was excavated to sterile clay.

The remainder of the profile unit was excavated to the surface of the older paleosol in one 10 cm level. The paleosol was excavated using arbitrary levels of 10 cm and five cm to the base of the paleosol at 45 cm BGS. These layers were combined for recording purposes. The tan clays below the paleosol were excavated in arbitrary 10 cm levels well into culturally sterile soil at a depth of 70 cm.

Cultural Horizon at Level 1 (5 cm BGS)

During the excavation of Unit 52S 27.8W, a possible cultural horizon was encountered at five cm, just below the modern sod layer within the uppermost incipient soil layer (Figure 26, Profile). Cultural materials were not encountered at this level in any of the adjacent excavated units. All other materials were in direct association with the Level 2 cultural horizon.

Four waste flakes were recovered from this level; two were KRF. Of these, one was a soft hammer tertiary flake (15-20 mm), and one was a tertiary flake (10-15 mm), of unknown

load application. One grey porcellanite tertiary flake (5-10 mm) and one red porcellanite tertiary flake (10-15 mm) were also recovered. Method of detachment of these flakes is unknown. No other cultural materials were associated with this horizon.

Cultural Horizon at Level 2

This cultural horizon was encountered at varying depths below the modern surface, eight to 13 cm. It was characterized by a distinct, dense layer of bone fragments, flakes, charcoal and an associated fire hearth, designated Feature 4. This level is located within the third incipient sod layer from the surface (Figure 27, Profile) and readily distinguishable by its dense cultural matrix.

Features. A single fire pit, Feature 4, was found in the center of the initial profile excavation next to the cutbank edges. This feature measured approximately 33 cm north-south and 30.5 east-west and extended to a depth of approximately four cm (Figures 27 and 28). The first evidence of this feature was encountered at 10 cm with the presence of burned bone, charcoal, ash, and flakes in a dark matrix.

The upper portion of the feature was indistinct and undefined until the dark cultural matrix was cleared away to the base of Level 2. The bottom of the feature was well defined with a dark circular area bordered by a light red peripheral area to the north. The feature was distinguished by the red, oxidized area of sandy brown loam, representing the base of a fire hearth.

The feature was not associated with a circular ring of hearthstones, and there was no associated fire-cracked rock. There is no evidence of an excavated basin or pit; and the hearth seems to have been fired on the surface and burned long enough for the deep, well defined, reddened, oxidized zone to form, as shown in the feature profile. The charcoal, bone, ash, and cultural materials were scattered in a wide and ill-defined arc to the east and south-east of the feature.

The feature contents were collected for flotation, floral and pollen identification. In addition, a large sample of the surrounding cultural matrix with dense charcoal layers was retained and floated. The subsequently recovered C-14

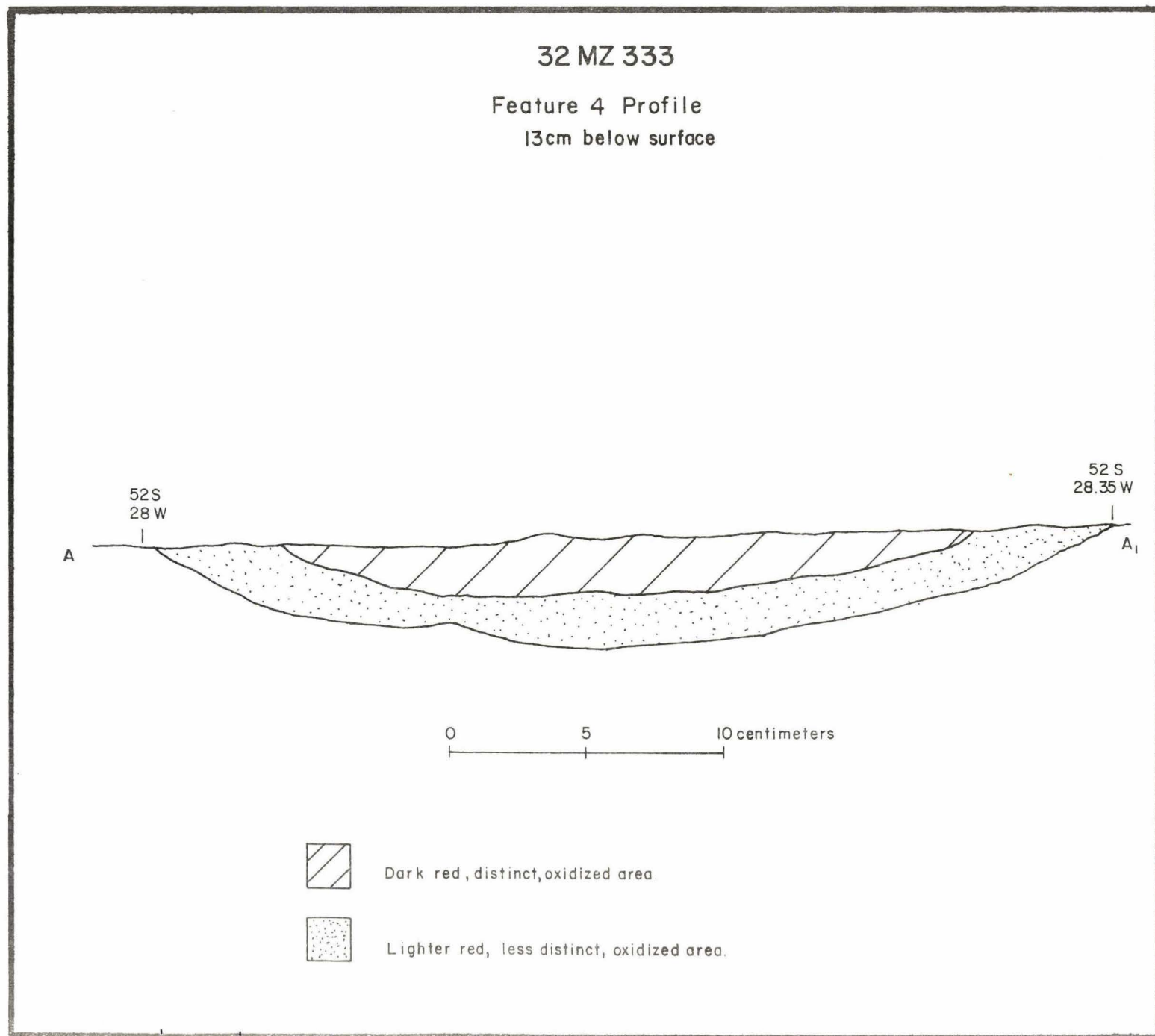


Figure 27

sample returned a date of 215±60 B.P. (Beta Analytic, Inc. 1982, see Appendix 7.1). This date may be slightly young due to possible rootlet contamination, and may be closer to ca. 315 B.P. (Stipp, personal communication 1982). The floral analysis revealed a variety of unburned seeds, insect fragments, and burned and unburned grass and twig fragments (Scott 1982, see Appendix 7.5).

Material Distribution

A total of 610 pieces of chipped stone were recovered from the cultural horizon at Level 2. Of these, only three were identified as patterned tools: two biface/projectile point tips and one endscraper. The remaining 607 flaked stone artifacts were classified as debitage. In addition, 40 ULM bone fragments, 17 ULM charred or burned bone fragments (less than 0.1 g), and one USM charred (less than 0.1 g) bone fragment were recovered.

All of the bone fragments and most of the flaked stone were recovered in Level 2 (ca. 7-20 cm). This corresponds with the presence of the recorded Feature 4 located at 13 cm BGS and represents the base of the suspected cultural occupation living floor. The difference in elevation is due to the eastward slope downhill from the cutbank edge.

The distribution of the recovered cultural materials is presented in Figure 28. When viewed as a single horizontal plane, the debitage is distributed non-randomly surrounding the hearth. There is a marked increase in density north-east of the hearth in Unit 52S 27.8W. Sixty-seven percent (N=405) of the debitage was recovered in this unit. Only 14.5 percent of the debitage (N=88) was recovered in the 53S 27.8W unit to the southeast of the feature. However, this is the area of the most dense bone, charcoal, and ash scatter as well as the location of a dense bone concentration immediately south of the hearth. Thirteen ULM bone fragments (2.2 g) were recovered from 52S 27.8W. From the above information, it appears that the great majority of stone working and maintenance occurred north and east of the hearth, while bone refuse and feature scatter were concentrated to the south and southeast. The validity of the interpretation is open to question since a large part of the living area west of the hearth has been eroded away. However, the above hypothesis is supported by the current material distribution and excavated living area remnants.

Artifact Description




Only three (0.5 percent) artifacts of the flaked stone artifacts recovered were classifiable as stone tools, showing

32 MZ 333

Plan View of Level 2

- △ Biface/Projectile Point Tip
- ▲ Biface/Projectile Point Tip
- Scraper

Area of less distinct
red discolorationBone
ConcentrationFeature
4A
profile
A53 S
27.8 W51 S
27.8 WDebitage
Density

-  n = 114
-  n = 405
-  n = 88

53 S
27 W52 S
27 W51 S
27 W

deliberate shaping to a desired form for a specific task or exhibiting evidence of use. The remaining 99.5 percent or 607 flaked stone artifacts were classified as debitage.

Patterned Tools

Projectile point tip (Figure 29b)

Raw material	Grey porcellanite
Weight	0.9 g
Length	21.0 mm (broken)
Width	10.0 mm
Thickness	3.5 mm

This artifact was recovered at 51.21S 28.34W at a depth of nine cm below surface. The specimen represents a probable projectile point tip broken through the midsection, possibly during manufacture. The biface is triangular in outline with irregular edges from rough pressure retouch. The blade edges are straight to slightly excurvate. The cross-section is bi-convex. The blade edges bear evidence of no use-wear; some grinding is present for edge strengthening. The irregular edge and crude manufacture, as well as the presence of grinding on the lateral margins, support the thesis of a break during manufacture.

Biface/Projectile Point Tip

Raw material	Grey porcellanite
Weight	0.2 g
Length	8.0 mm (broken)
Width	7.0 mm
Thickness	3.5 mm

This artifact was recovered at 51.37S 27.62W at 10 cm BGS. The specimen is believed to represent a projectile point tip due to the small size and good workmanship. The specimen exhibits crude bifacial retouch along the margins and may also have been broken during manufacture. The cross-section is bi-convex; edges are irregular and bear no evidence of use-wear.

Endscraper (Figure 29s)

Raw material	KRF
Weight	52.0 g
Length	19.0 mm (broken)
Width	25.0 mm
Thickness	8.0 mm
Length retouched edge	35.0 mm

This artifact was recovered at 52.5S 27.8W at a depth of 10 cm BGS. The endscraper was manufactured on a large

flake blank of KRF, and exhibits steep distal retouch forming a rounded, convex working edge with a distinct spur present on the left lateral side of the distal, working edge. The artifact does not exhibit extensive use-wear and is still relatively sharp.

Three patterned tools were recovered. Two (66.6 percent) are grey porcellanite, and one (33.3 percent) is KRF. The largest tool class is biface/point tips; both specimens are manufactured from porcellanite. The second largest class is endscrapers of KRF.

Debitage

Collected from Level 2 were 607 pieces ofdebitage. These waste flakes are summarized in Tables 22 through 25. Four types of raw material (Table 22) were present in the cultural horizon: KRF, chalcedony, grey porcellanite, and obsidian. The most frequently used raw material was KRF (N=305 or 50.2 percent), followed by chalcedony (N=201 or 33.1 percent), porcellanite (N=100 or 16.5 percent), and obsidian (N=1 or 0.2 percent). This single obsidian flake was submitted to MOHLAB for hydration dating and source identification.

The predominant flake subcategory (Table 23) is tertiary, which makes up 98.1 percent of the collection (N=595), followed by primary and thinning flakes at 0.8 percent (N=5), and secondary flakes at 0.3 percent (N=2). The predominant flake category for each raw material present is the tertiary class ranging from 96.5 percent for chalcedony to 99 percent of the KRF (100 percent of obsidian).

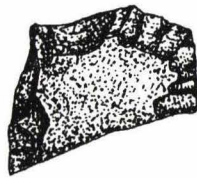
It is also interesting that the raw materials are similar in regard to flake size categories, with 85.5 percent (N=519) of the flakes smaller than 10 mm. Smaller than 15 mm are 98.2 percent or N=596.

Faunal Analysis

The faunal remains were submitted to Stephen Chomko of Paleo-Environmental Consultants for identification and tabulation. None of the recovered bone was identifiable as to species. The results are presented in Table 26.

Analysis and Discussion

Of the flaked stone artifacts recovered, none are complete enough or bear diagnostic elements to warrant identification or typing to



a



b

Figure 29

Table 22

Summary of Unmodified Debitage:
Counts and Percentages by Raw Material and Group Size

139

Group Size (mm)	KRF	Chalcedony	Grey Porcellanite	Obsidian	Total	%
0-5	73	74	46	--	193	31.8
5-10	186	96	44	--	326	53.7
10-15	38	30	8	1	77	12.7
15-20	8	--	1	--	9	1.4
20-25	--	--	--	--	--	--
25-30	--	--	1	--	1	0.2
30-35	--	--	--	--	--	--
35-40	--	--	--	--	--	--
40-45	--	1	--	--	1	0.2
Totals	305	201	100	1	607	100
%	50.2	33.1	16.5	0.2	100	

Table 23

Count and Percent of Raw Materials
By Flake Subcategory for Unmodified Debitage

Raw Material	Primary		Secondary		Tertiary		Thinning		Total	
	#	%	#	%	#	%	#	%	#	%
KRF	2	0.7	1	0.3	302	99.0	--	--	305	
Chalcedony	3	1.5	1	0.5	194	96.5	3	1.5	201	
Grey porcel- lanite	--	--	--	--	98	98.0	2	2.0	100	
Obsidian	--	--	--	--	1	100.0	--	--	1	
Total	5	0.8	2	0.3	595	98.1	5	0.8	607	100

Table 24

Summary of Unmodified Debitage
By Method of Manufacture

Load Application	Primary		Secondary		Tertiary		Thinning		Totals	
	#	%	#	%	#	%	#	%	#	%
Hard hammer	--	--	--	--	--	--	--	--	--	--
Soft hammer	--	--	--	--	10	66.6	5	33.3	15	99.9
Direct pressure	--	--	--	--	428	100.0	--	--	428	100.0
Unknown	5	3.0	2	1.2	157	95.8	--	--	164	100.0
Totals	5	0.8	2	0.3	595	98.0	5	0.8	607	99.9

Table 25

Level 2 Cultural Horizon
Summary of Debitage by Group Size
And Weight by Raw Material

<u>Group Size</u>	<u>KFR Wt (g)</u>	<u>Chalcedony Wt (g)</u>	<u>Grey Porcellanite Wt (g)</u>	<u>Obsidian Wt (g)</u>	
0-5	0.9	0.8	0.7	--	
5-10	11.2	5.3	2.6	--	
10-15	6.3	4.3	3.1	0.1	
15-20	2.7	--	0.4	--	
20-25	--	--	--	--	
25-30	--	--	0.3	--	
30-35	--	--	--	--	
35-40	--	--	--	--	
40-45	--	3.0	--	--	
Totals	21.1	10.7	9.8	0.1	41.7

known cultural assemblages. However, the two non-diagnostic biface/projectile point tips are small enough and of the general character to fit nicely into the Late Prehistoric Period, which is consistent with the date of 215±60 B.P. at Feature 4. Of the remaining stone artifacts, none can be considered temporally diagnostic.

Associated with the stone tools are the remains of a small hearth, charcoal, ash, bone fragments, and charred bone fragments that indicate that meat was prepared and eaten at the site. Identification of the bones has revealed the presence of both large mammal and small mammal bone fragments, none identifiable as to species. The cultural scatter is relatively light-to-moderate, as is the flaking debris which indicates a relatively short occupation of the site, probably as a short-term hunting camp.

The cultural remains suggest that manufacture and maintenance of tools were among the dominant activities at the site. The manufacture of the stone tools was limited to the latter stages and final shaping/sharpening, rather than the entire lithic reduction sequence. This is clearly indicated for reasons to be discussed briefly below.

Primary and secondary flakes are associated with the early stages of lithic core reduction. Tertiary and thinning flakes are associated with manufacture of blanks and latter stages of reduction. Primary and secondary flakes are virtually absent from Level 2; cores are totally missing from the assemblage. The overwhelming dominance of the tertiary category (98.1 percent) supports the thesis that principally the latter stages of reduction were carried out at the site.

This is further supported by the presence of few soft hammer flakes (only 2.5 percent) and very few thinning flakes (only 0.8 percent). This is strong evidence for the latter stages of manufacture/maintenance.

The dominant mode of manufacture is direct pressure (70 percent) which is commonly the last stage of manufacture and also associated with tool maintenance. Further evidence is supplied by the dominance of small flaking debris, over 50 percent under 10 mm in size. This size flake would be most commonly associated with latter stages of manufacture and pressure flake removals. The evidence suggests the reduction of prepared tool blanks to finished artifacts and/or maintenance of existing tools which were carried from the site and not discarded.

Table 26

Faunal Remains -- Profile Cut 1, Level 2

<u>Unit</u>	<u>ULM</u>	<u>Wt (g)</u>	<u>ULM Charred</u>	<u>Wt (g)</u>	<u>USM</u>	<u>Wt (g)</u>	<u>USM Charred</u>	<u>Wt (g)</u>
Profile Cut 1	41	15.9	10	3.6	2	<0.1	1	<0.1
52S 27.8W	13	2.2						
53S 27.8W	36	7.4	7	1.6				
Total	90	25.5	17	5.2	2	<0.1	1	<0.1

Cultural Horizon in Level 4 (ca. 26 cm BGS)

A third cultural horizon was encountered in Level 4 within the broad dark paleosol representing the older soil horizon. This horizon was present in both the north half and south half of the profile cut and was relatively sparse in nature. Ten flakes and two bone fragments were recovered from this level.

The lithic materials are summarized in Table 27. Of particular interest is the distinctive moss agate raw material of clear chalcedony with definite black inclusions. Thinning and tertiary flakes suggest the presence of latter stages of biface manufacture but the evidence is too sparse to draw any direct conclusions.

The two bone fragments were not identifiable by genus. One fragment of 0.2 g was typed as ULM; the other fragment was less than 0.1 g in weight, typed as USM (Chomko 1982; see Appendix 7.4).

No diagnostic artifacts or datable materials were present. Comparisons to other assemblages and determination of site activities from the horizon are not possible due to the sparse nature of the remains.

No other cultural materials were encountered in the Profile Cut 1 excavations to 70 cm BGS.

Profile Cut 2

The placement of Profile Cut 2 was determined by the presence of numerous unidentifiable large mammal bone fragments and several lithic artifacts, eroding from the cutface and on the surrounding slope-washed edge west of the site. The materials collected from the surface are summarized below.

<u>Biface/Blank</u>	
Raw material	Grey porcellanite
Weight	6.4 g
Length	38.0 mm
Width	26.0 mm
Thickness	7.5 mm

This artifact was collected from the side of the draw on the bentonite clay surface west and below the site cutbank.

Table 27

Debitage from Profile Cut 1, Level 4

<u>Material</u>	<u>Size</u>	<u>Number</u>	<u>Weight (g)</u>	<u>Description</u>
KRF	10-15 mm	4	0.8	3 - tertiary, unknown 1 - tertiary, soft hammer
Moss Agate	15-20 mm	2	0.7	1 - tertiary, soft hammer 1 - tertiary, unknown
Red	10-15 mm	1	0.3	tertiary, soft hammer
porcellanite	25-30 mm	1	1.4	thinning, soft hammer
Grey				
porcellanite	10-15 mm	1	0.4	thinning flake, soft hammer
Petrified wood	30-35 mm	1	3.2	angular debris - cortical

The artifact is a complete, leaf-shaped, blunt pointed bi-face. The blade edges are excurvate and irregular in outline. The flaking is irregular with remnants of both percussion and pressure removals. The stem-base juncture is obtuse, rounded with no modifications for hafting or notches. There is no observed use-wear on the lateral edges but evidence of grinding is present. The artifact is probably a blank, not yet sufficiently defined to be called a preform.

Utilized Flake

Raw material	KRF
Weight	2.2 g
Length	29.0 mm
Width	22.0 mm
Thickness	4.0 mm

This is a large tertiary flake which exhibits use-wear on the left lateral and distal margins. The use-wear is highlighted by microflaking from the dorsal surface perpendicular to the edge with feathered terminations. A scraping motion on soft material is suggested.

Debitage

Debitage is tabulated below.

<u>Material</u>	<u>Size(mm)</u>	<u>#</u>	<u>Wt(g)</u>	<u>Flake Type</u>	<u>Production Mode</u>
KRF	20-25	1	1.1	tertiary	soft hammer percussion
Moss Agate	25-30	1	2.5	secondary	unknown

Stratigraphy

A two-meter section of the cutface was placed over the suspected source of the cultural materials at 83-85 meters south and extending west to the edge of the cutbank from 20 meters west of site datum. The cutface was handfaced to define the stratigraphy present. As in Profile Cut 1, the soil was extremely dry, compacted and hard to define until wet. The excavated profile unit (east wall) is presented in Figure 30.

The upper soil zone of light brown sandy loams, of recent eolian origin, was approximately 29-32 cm thick at Profile Cut 2. The older, underlying paleosol was approximately 25

cm thick. These two soil zones overlay a sterile sandy clay, tan in color, as in Profile Cut 1.

The distinct dark black bands representing incipient soils were again present in the upper, recent eolian soil. A series of seven incipient soils were present at this profile cut (eight if the modern sod layer is included). Observation of the bands reveals that they are intermittent and pinch out downslope, to the north. The second soil band from the surface at 13-14 cm exhibited a dense layer of charcoal and cracked bone and represented a cultural level. No other cultural layers were visible in the stratigraphic profile.

Excavation Methodology

As in Profile Cut 1, Level 1 was excavated to 14 cm to the top of the visible cultural horizon, which was readily distinguished by the dense cultural matrix. Level 2 was removed to 20 cm, encompassing the cultural level and a portion of the sterile stratum beneath it.

To ascertain the presence of cultural materials in the remaining incipient soil bands, the approximate depths and thicknesses of each band were measured in the profile wall. Levels of about the same thickness were then removed to approximate the visible strata. The remainder of the unit was excavated in a manner similar to Profile Cut 1.

Cultural Horizon at Level 2 (14 cm BGS)

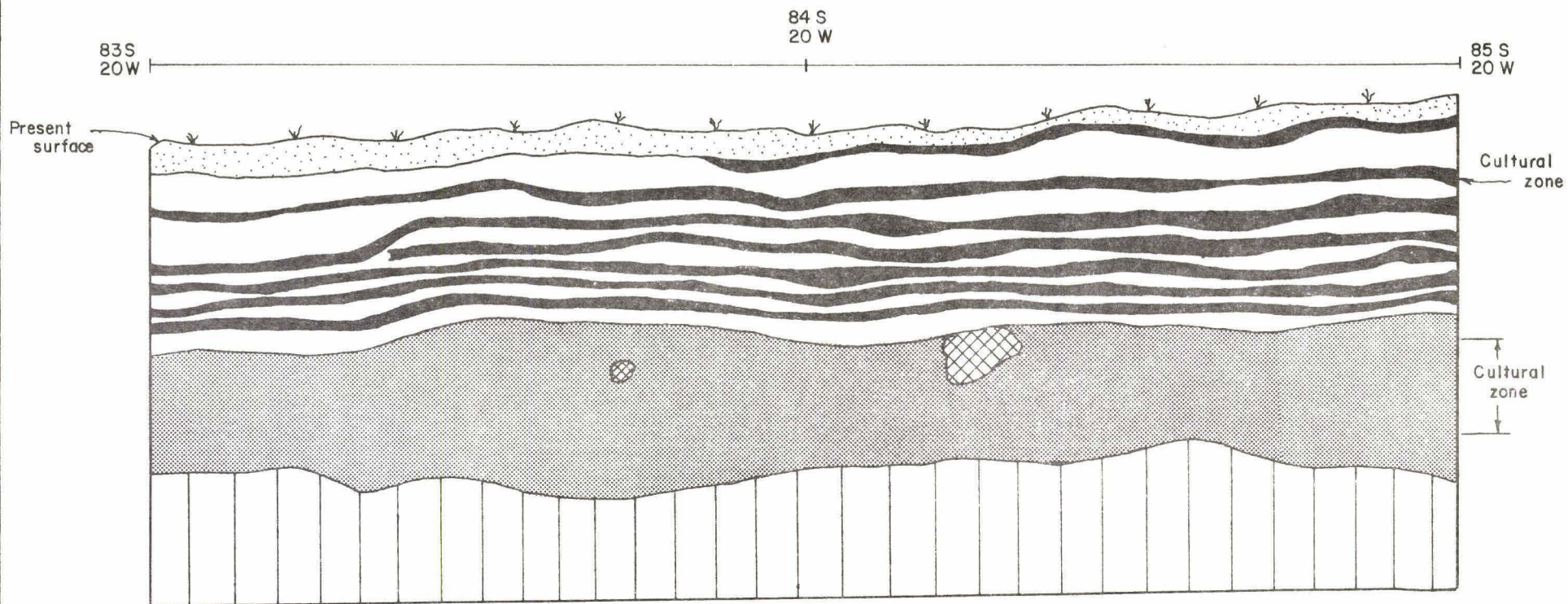
Features. A single feature, No. 6, was encountered at 14 cm BGS in the south half of the profile cut, near the cutbank edge. The feature measured eight cm north-south by 10 cm east-west, centered at 84.6 meters south 20.19 meters west (Figure 31). The first evidence of the feature was encountered at 14 cm amid the bone, charcoal, and dark cultural matrix.

The feature is represented by an amorphous red and black, roughly circular stain, with small traces of white, possible ash. The exact nature and function of the feature is unknown. It may have been a hearth but, if so, it was fired for only a very short period, as no distinct deep red oxidized layer is present. In profile its depth was negligible.

Figure 30

32 MZ 333

Profile cut 2
East wall



-  Sod layer, dark brown loam
-  Dark brown sandy loam bands; incipient soil zones
-  Light brown sandy loam
-  Dark brown/black sandy loam - Paleosol
-  Tan sandy clay
-  Rodent Burrows

0 10 centimeters

Material Distribution

A total of only six pieces of chipped stone were recovered from the cultural horizon at 14 cm. All are classified as debitage. In addition, a total of 156± ULM bone fragments and two Artiodactyl teeth fragments were recovered.

All of the bone and flakes were recovered in direct association with the cultural horizon at 14 cm BGS in either Level 1 or 2. The living surface is believed to be at 14 cm where the feature was first encountered and recorded.

The distribution of the material is not informative. The south half of the unit contained 70+ bone fragments (24.4 g) and two waste flakes. The north half contained 86+ bone fragments (32.8 g) and four flakes. The materials appeared to have been distributed somewhat randomly around the feature. Larger areas of excavation would be necessary to define meaningful material distribution of the cultural materials.

Artifact Description

Only eight flaked stone artifacts were recovered from the cultural horizon at Level 2, 14 cm BGS. All have been classed as debitage. No tools or diagnostic artifacts were recovered.

Debitage

The eight pieces of stone debitage are described below.

<u>Material</u>	<u>Size(mm)</u>	<u>#</u>	<u>Wt(g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
KRF	10-15	3	0.5	tertiary	soft hammer direct pressure unknown
	15-20	1	0.7	tertiary	unknown
Grey por- cellanite	10-15	1	0.2	tertiary	unknown
White chert	0-5	1	0.1	tertiary	direct pressure
Chalcedony	0-5	1	0.1	tertiary	direct pressure
	5-10	1	0.1	tertiary	direct pressure

Figure 31

32 MZ 333
Profile Cut 2
Plan View

Terrace Edge

Feature 6

85 S
20 W

84 S
20 W

83 S
20 W

0 10 20 centimeters

N

Table 28

Bone
Profile Cut 2, Level 2

<u>Excavation Unit</u>	<u>ULM</u>	<u>Wt</u>	<u>Teeth</u>	<u>Wt</u>
S $\frac{1}{2}$ Level 2 14-20 cm	70+	24.4g	1 Artio. fragment	0.1g
N $\frac{1}{2}$ Level 1 0-14 cm	36	18.5g		
N $\frac{1}{2}$ Level 2 14-20 cm	50+	13.8g	1 Artio. fragment	0.3g
Totals	156+	56.7g	2	0.4g

Profile Cut 2, Level 5

<u>Excavation Unit</u>	<u>Teeth</u>	<u>Wt</u>
Level 5 36 cm BGS	2 Bison fragments	1.9g

Four types of raw material were present: KRF (N=4 or 50 percent), grey porcellanite (N=1, 12.5 percent), white chert (N=1, 12.5 percent), and chalcedony (N=2, 25 percent). All of the flakes are tertiary and less than 15 mm in size. One flake was detached by soft hammer percussion (12.5 percent), four by direct pressure (50 percent), and three (37.5 percent) are of unknown mode of manufacture.

Faunal Analysis

Chomko's analysis of the recovered bone fragments are presented in Table 28. None were identifiable by genus or species.

Analysis and Discussion

No artifacts that can be considered diagnostic of temporal affiliations were recovered, nor were datable cultural materials. However, based upon its location in the upper soil horizon at about the same level as the upper cultural horizon in Profile Cut 1, the level can be assumed to be of Late Prehistoric period age. The presence of cracked bone, charcoal, and similar types of lithic materials may indicate a relationship with the horizon in Profile Cut 1, but no direct correlation is possible at this time.

The cultural materials recovered from the unit are too sparse in nature to allow determination of the exact nature of the site activity. A larger excavation area at the existing cut would be necessary.

Cultural Horizon at Level 5 (ca. 36-45 cm BGS)

A second cultural horizon was encountered in the broad dark paleosol representing the older soil horizon. This soil horizon was present in both the north and south halves of the profile cut and was very sparse. Four flakes and one bison tooth fragment were recovered from this level.

Debitage

The four flakes are summarized below:

<u>Material</u>	<u>Size (mm)</u>	<u>#</u>	<u>Wt (g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
KRF	15-20	2	0.9	tertiary	1 soft hammer 1 unknown
Chalcedony	5-10	2	0.3	tertiary	1 direct pressure 1 unknown

Faunal Analysis

The faunal remains are summarized in Table 28.

No diagnostic or datable materials were present. Comparison to other assemblages and determinations of activities conducted at this area are not possible due to the sparse materials encountered.

4.2 SITE 32MZ334

Previous investigations had concluded that the remains of this site were smaller in extent and less complex than 32MZ333. This was generally confirmed by the present investigation, which began with a program of shovel probes placed at intervals along transects, similar to the testing of Site 32MZ333. Few of these probes indicated the presence of any subsurface cultural materials, consequently only eight 1 x 1 meter units were excavated, and no large block excavation units were undertaken. The probes and excavation units are discussed separately below.

4.2.1 Shovel Probes

A total of 78 shovel probes were placed across the lateral north-south limits of Site 32MZ334. The probes were placed in three parallel transects, shown in Map 4. Of the 78 probes, 6.4 percent (N=5) produced cultural materials. A summary of the shovel probes is contained in Tables 29 to 31.

The results of the shovel probe phase of the investigation indicate that little of the site remains in the area adjacent to the road impact corridor, based upon the small number of productive probes and the few artifacts recovered. However, the probes did reveal variable stratigraphy over the various portions of the site.

In general, the probes located east of the current road (Transects 2 and 3) revealed a totally different stratigraphy from those west of the road (Transect 1). Probes placed east of the road revealed a deep eolian deposit of sands and sandy loam, largely undifferentiated but with slight color and textural changes according to depth, overlying a dark incipient soil band present along the entire small terrace west of the road. Beneath this layer was a light brown loam of variable thickness overlying sterile clays.

4.2.2 One-by-One Meter Units

Eight 1 x 1 meter squares were excavated at Site 32MZ334 (Map 4). Five of these units were placed over productive probes; one was placed adjacent to an in situ quartzite cobble in the cutbank of the east road edge; and two were placed in areas of high probability after consultation with USFS archaeologists. Each of these 1 x 1 units is discussed below.

Unit 15N 0W

This unit was placed over productive Probe 16, Transect 3. The square was excavated using arbitrary 10 cm levels to 50 cm BGS. The stratigraphy was characterized by four-five cm of brown, sandy, loam sod overlying a dark brown, sandy loam with extensive root and rodent disturbance to 45-50 cm, which overlies a very compact tan grey clay, illustrated in Figure 32.

Cultural materials were recovered from Levels 1 through 4. The total, seven flakes, is described below:

<u>Material</u>	<u>Size (mm)</u>	<u>#</u>	<u>Wt (g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
Level 1 (0-10)					
Chalcedony	15-20	1	0.7	tertiary	unknown
Level 2 (10-20)					
Chert	20-25	1	0.8	tertiary	soft hammer
KRF	10-15	1	0.7	angular debris	unknown
Level 3 (20-30)					
Chalcedony	5-10	1	0.1	tertiary	direct pressure
Coarse chert	10-15	1	0.4	tertiary	unknown
Coarse chert	20-25	1	3.0	angular debris	unknown
Level 4 (30-40)					
KRF	30-35	1	4.1	secondary	soft hammer

Due to the extensive bioturbation present within the sands of the unit profile, the exact nature of the cultural stratigraphy is unknown. The materials have been subjected to movement up and down within the profile. Further, the materials were recovered from screening and their context is questionable.

Table 29

32MZ334 - Shovel Probe Summary
Transect 1

Probe	Elevation from Datum (m +/-)	Soil Depth (cm)	Total Depth (cm)	Comments-Associations	Cultural Materials
1	+0.85	30	36	Fine grain dark brown loam	None
2	+0.91	35	39	Same as above	None
3	+0.67	20	31	Same as above	None
4	+0.51	30	40	Same as above	None
5	+0.39	38	43	Same as above	None
6	+0.25	35	40	Same as above	None
7	+0.03	17	28	Same as above	None
8	-0.19	23	35	Same as above	None
9	-0.56	48	52	Same as above	None
10	-0.86	59	61	Same as above	None
11	-0.79	40	43	Dk. brn. band - incipient soil zone ca. 26 cm	1 petrified wood shatter flake
12	-0.77	40	41	Incipient soil 15-18 cm, granitic rock ca. 35 cm	None
13	-0.97	33	40	Incipient soil 13-16 cm	? chert flakes (10-20 cm)
14	-1.61	35	40	Incipient soil 12-15 cm	None
15	-2.40	65	67	Incipient soil 8-11 cm	None
16	-2.89	70	73	Incipient soil 14-17 cm, possible 2nd soil ca. 30 cm	None
17	-2.86	60	60	Incipient soil 19-21 cm, possible 2nd soil 31 cm	None
18	-2.79	35	55	Incipient soil 14-16 cm	None
19	-2.75	20	40	Incipient soil 10-12 cm	None
20	-3.46	25	36	Grey clay, lignite band 8-10 cm	None
21	-3.56	28	35	Incipient soil 10-13 cm	None
22	-3.97	28	30	Incipient soil 11-13 cm	None
23	-4.21	28	28	Incipient soil 7-10 cm	None
24	-4.36	12	25	Incipient soil 5-7 cm	None
25	-4.76	15	35	---	None

Table 30

32MZ334 - Shovel Probe Summary
Transect 2

Probe	Elevation from Datum (m +/-)	Soil Depth (cm)	Total Depth (cm)	Comments-Associations	Cultural Materials
1	+0.74	42	43	Clay loams	None
2	+0.64	46	51	Clay loams	None
3	+0.38	35	50	Clay loams	None
4	+0.19	35	44	Red porcellanite flake in road disturbance by probe	None
5	-0.21	27	51	Clay loams	None
6	-0.35	34	50	Clay loams	None
7	-0.40	40	46	Clay loams	None
8	-0.37	36	45	Increasing sand content	None
9	-0.18	34	42	Increasing sand content	None
10	-0.05	39	50	Sand loams, no clays	None
11	-0.11	53	53	Sand, sand loams, petrified wood fragments	None
12	-0.15	61	61	Same as above	None
13	-0.13	58	58	Same as above	None
14	-0.15	48	48	Same as above	None
15	-0.38	40	40	Same as above	None
16	-0.73	30	38	Same as above	None
17	-1.34	42	48	Same as above	None
18	-1.67	43	45	Sand, silt loams	None
19	-1.88	36	43	Sand, silt loams	None
20	-1.95	43	50	Sand, silt loams	None
21	-2.09	40	48	Sand, silt loams	None
22	-2.25	34	42	Sand, silt loams	None
23	-2.71	44	50	12-30 dark brown loam	4 unidentifiable bone fragments
24	-3.48	23	40	Sand, silt loams	None
25	-3.75	33	40	Sand, silt loams	None
26	-4.13	30	40	Sand, silt loams	None
27	-4.46	34	34	Sand, silt loams	None
28	-2.93	34	46	Sand, silt loams	None

Table 31

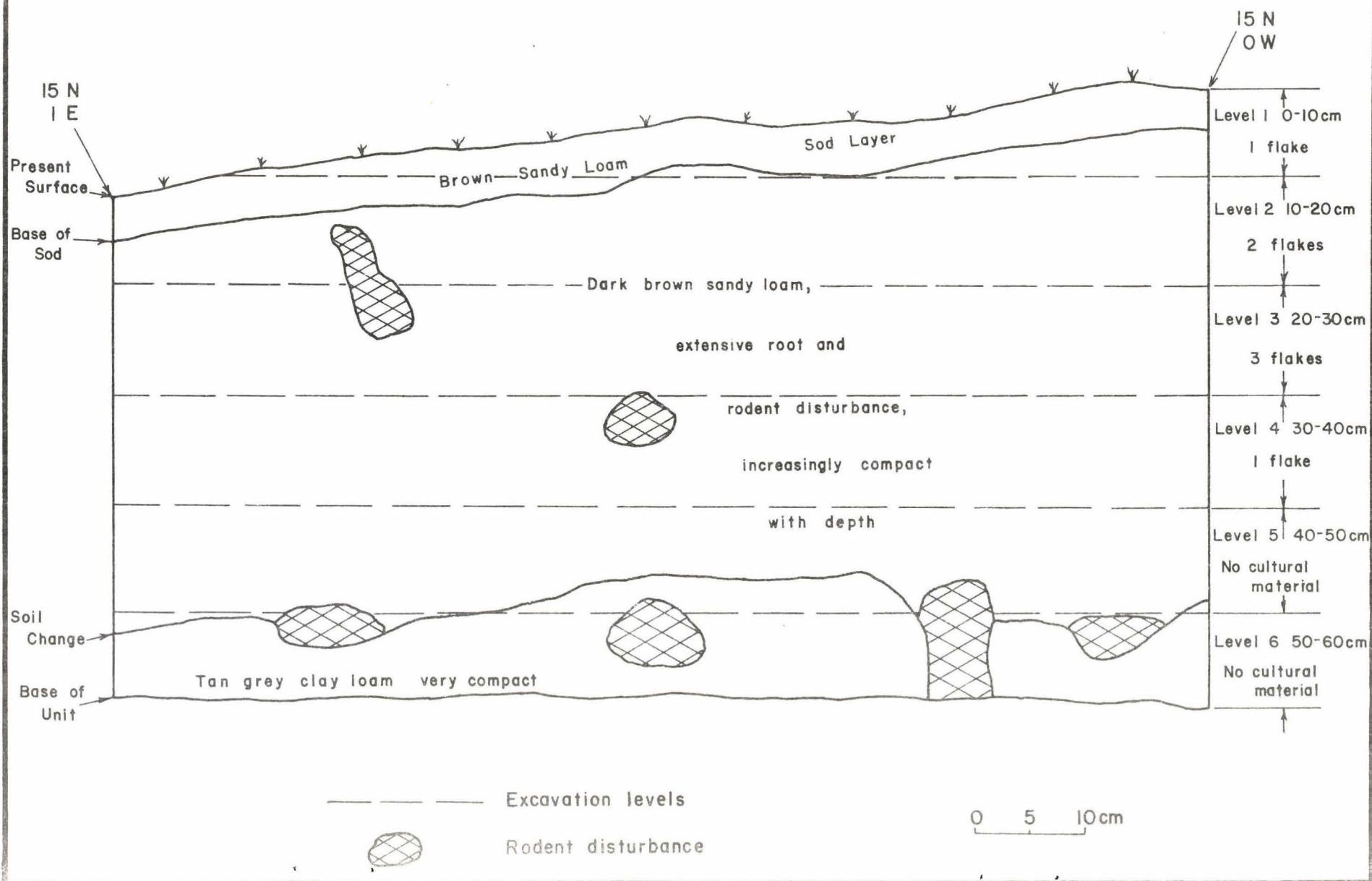
32MZ334 - Shovel Probe Summary
Transect 3

Probe	Elevation from Datum (m +/-)	Soil Depth (cm)	Total Depth (cm)	Comments-Associations	Cultural Materials
1	-3.75	36	47	Dk. brn. loams, pet. wood fragments throughout	None
2	-3.18	26	32		None
3	-2.69	26	36		None
4	-2.27	29	33		None
5	-1.80	30	37	Sand, sand loams undiff.	None
6	-1.45	30	30		None
7	-0.96	29	46		None
8	-0.93	35	35		None
9	-0.75	20	28		None
10	-0.50	30	30		None
11	-0.27	22	30		None
12	-0.12	28	28		None
13	-0.003	44	63		None
14	-0.11	80	82		None
15	-0.24	66	66	ca. 0-23 cm	1 petrified wood flake
16	-0.35	50	52		1 KRF flake
17	-0.56	49	49		None
18	-0.71	41	52		None
19	-0.83	31	48		None
20	-0.81	41	49	Loams - increasing silts/ clays	None
21	-0.83	45	45	12+14 former surface/soil	None
22	-0.74	43	43	10-14 faint former surface	None
23	-0.47	36	35		None
24	-0.19	35	50		None
25	-0.20	19	34	15-19 faint former surface	None

Figure 32

32 MZ 334

Unit 15 North O West South wall profile



Unit 9N 0W

This unit was placed over productive Probe 15 of Transect 3. The square was excavated using arbitrary 10 cm levels to a depth of 50 cm. The southeast corner was then arbitrarily taken to a depth of 70 cm. The stratigraphy was similar to 15N 0W, characterized by dark brown sandy loams to 50 cm, where a change to a lighter brown sandy loam occurred which continued to the bottom of the unit. Cultural material recovered from Level 2(10-20) consisted of one flake:

<u>Material</u>	<u>Size(mm)</u>	<u>#</u>	<u>Wt(g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
KRF	30-35	1	4.2	secondary	unknown

As with the 15N 0W, the unit is heavily disturbed by rodent burrowing and root penetration. The cultural context of the flake recovered is questionable.

Unit 1N 6W

This unit was placed adjacent to a large water-rolled quartzite cobble/core or secondary flake in situ from the bulldozer cutbank of the Abraxas road and exposed approximately 15 cm BGS in Unit 1N 7W. The artifact exhibits evidence of hard hammer removal from a larger piece and subsequent hard hammer flake removals. There is no evidence of further utilization. The artifact is described as follows:

Weight	254.4 g
Length	107.0 mm
Width	71.0 mm
Thickness	37.0 mm

Unit 1N 6W was excavated using arbitrary 10 cm levels to a depth of 60 cm BGS. The stratigraphy is identical to the deep eolian sands present in 15N 0W and 9N 0W. The soils consisted of brown sandy loams increasing in sand content and lighter in color with depth.

Cultural materials were recovered in Levels 2, 3, and 5. These materials comprise eight pieces of flaked stone, described on the following page:

<u>Level</u>	<u>Material</u>	<u>Size (mm)</u>	<u>#</u>	<u>Wt (g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
Level 2 (10-20)	KRF	5-10	3	0.25	tertiary tertiary	soft hammer direct pres- sure
	Chalcedony	5-10	1	0.15	tertiary tertiary	unknown unknown
Level 3 (20-30)	Chert	15-20	2	0.08	tertiary thinning	unknown soft hammer
	KRF	15-20	1	0.04	tertiary	unknown
Level 5 (40-50)	Chalcedony	5-10	1	0.02	tertiary	unknown

Unit 47S 13E

This unit was placed over productive Probe 23, Transect 2, and was excavated using arbitrary 10 cm levels to 50 cm BGS. The soil profile consisted of a dark brown loam sod layer to 5 cm. A light brown loam 7.5-8.0 cm thick, lay beneath this layer. A 20 cm thick, dark brown-black loam with a high silt content underlay this unit. Beneath this layer was a light brown-tan sandy clay (see Figure 33).

Cultural material was recovered from Level 1 only. The material, a single artifact, was a small triangular biface fragment or projectile point tip of KRF, described below:

Weight	0.6 g
Length	11.0 mm (broken)
Width	11.0 mm
Thickness	3.5 mm

The projectile point was manufactured by bifacial retouch of a small tertiary flake of KRF. The artifact exhibits fine pressure retouch along both dorsal and ventral surfaces. The flaking pattern is irregular, and the tool appears to have been broken during manufacture. The point is blunt and rounded. Examination of the edges shows evidence of grinding but no identifiable use-wear.

Unit 7S 21W

This unit was placed over productive Probe 13, Transect 1. The square was excavated using natural stratigraphy visible in the shovel probe. Level 1 consisted of a dark brown sandy loam sod zone with concretions; Level 2 was a light

brown coarse sand with grey sandy clay concretions; Level 3, a dark brown-black sandy loam buried surface/incipient soil zone; Level 4, a homogenous dark brown loam between the incipient soil and underlying sterile clays (see Figure 34).

Level 4 was excavated using arbitrary five cm levels through the 10-15 cm thick level and later combined into one unit.

Cultural material in this unit was confined to Level 4 where 14 pieces of flaked stone were recovered. The materials, of red and grey porcellanite, are described below:

Retouched Flake/Scraper

Weight	2.0 g
Length	15.0 mm
Width	23.0 mm
Thickness	4.0 mm

This tool was manufactured on a small broken tertiary flake of red porcellanite. The artifact exhibits steep retouch along the lateral edge with evidence of use-wear in the form of step-flaking perpendicular to the utilized edge. The length of the retouched/utilized edge is 12.0 mm.

Debitage

Debitage is described below:

<u>Material</u>	<u>Size (mm)</u>	<u>#</u>	<u>Wt (g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
Red por-cellanite	10-15	2	0.6	tertiary	unknown
	15-20	2	0.6	tertiary	unknown
	20-25	5	4.4	1 secondary	unknown
				1 tertiary	soft hammer
				3 tertiary	unknown
	25-30	2	3.9	tertiary	unknown
Grey por-cellanite	15-20	1	0.6	tertiary	unknown
	20-25	1	1.5	tertiary	unknown

Unit 55N 22W

This unit, which was placed over productive Probe 11 of Transect 1, was excavated using the same natural levels as in Unit 7S 21W. The probe revealed almost identical levels although of varying thickness.

Figure 33

32 MZ 334

Unit 47 South 13 East East wall profile

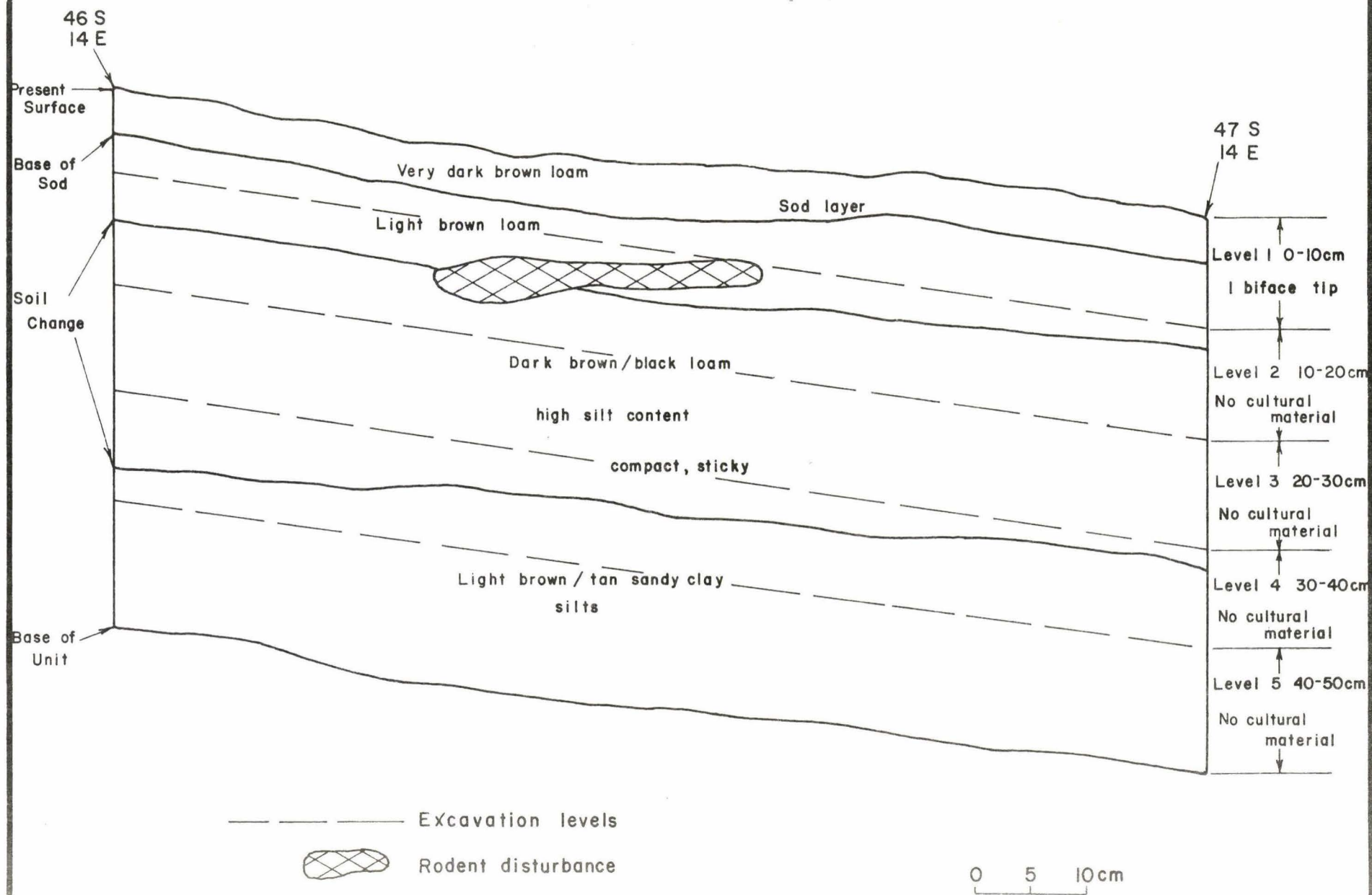
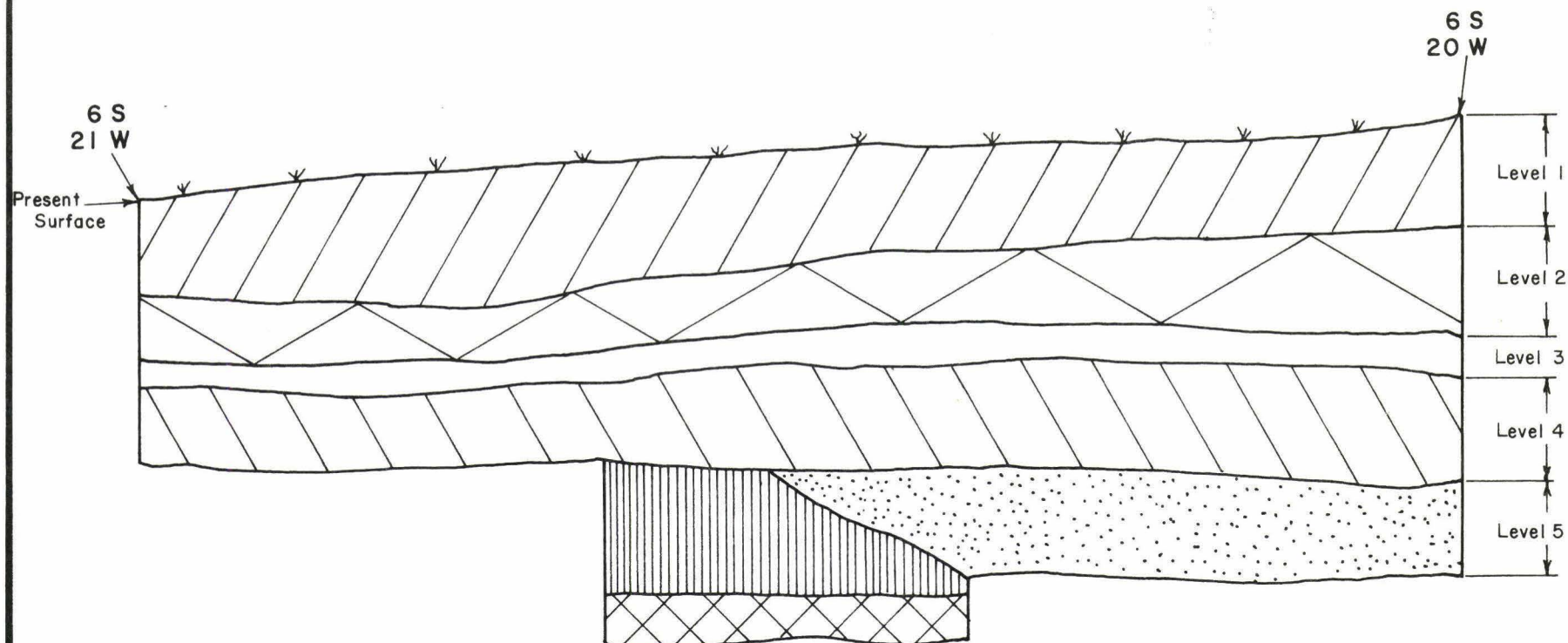









Figure 34

32 MZ 334
Unit 7 South 21 West North wall profile



-  Dark brown sandy loam. Sod and soil zone. Mottled with grey sandy clay concretions. Level 1
-  Light brown coarser sand. Mottled with same grey concretions. Level 2
-  Dark brown/black sandy loam. Buried surface, incipient soil zone. Level 3
-  Dark brown sandy loam, grades lighter at base. Homogenous. Level 4 (cultural)
-  Light grey sandy clay, heavily mottled with dark inclusions and root casts. Level 5
-  Reddish-orange-brown sand with red-brown sandstone fragments.
-  Grey clays

0 5 10 cm

All cultural materials from this unit were within Level 1 (0-10 cm) of the dark brown sandy loam soil and sod layer, well above the buried incipient soil. No cultural materials were recovered from Level 4 below the buried surface/soil zone as in 7S 21W. A total of five pieces of flaked stone were recovered from the level.

<u>Material</u>	<u>Size(mm)</u>	<u>#</u>	<u>Wt(g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
KRF	10-15	1	0.2	tertiary	unknown
KRF	15-20	1	0.2	tertiary	unknown
Chalcedony	5-10	1	0.2	tertiary	direct pressure
Red por-cellanite	20-25	1	1.2	tertiary	sure unknown
Red por-cellanite	30-35	1	3.1	secondary	unknown

In addition, two large unworked granitic rocks were recovered at 10 cm BGS. Total weight of the rocks is 66.4 g.

Unit 0N 23W

This unit was excavated between Units 7S 21W and 5N 22W. Each of the above units had produced cultural materials, each from a different level and horizon. This unit was placed to further define the nature of these cultural horizons and deposits. The same natural stratigraphy existed in this as well as the above units. Levels 1 and 2 were thinner to the west, with the buried soil almost present at the surface in the southeastern corner of the unit and with Level 2 pinching out to the west. Level 4, below the incipient soil zone, was much thicker than in the other excavated units.

Cultural materials were recovered from Levels 1, 2, and 3. The six pieces of flaked stone debitage are described below:

<u>Material</u>	<u>Size(mm)</u>	<u>#</u>	<u>Wt(g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
Level 1					
Red por-cellanite	25-30	1	3.8	secondary	unknown
Chert	10-15	1	0.2	tertiary	unknown
Level 2					
Red por-cellanite	20-25	1	1.6	angular debris	unknown
Level 3					
Red por-cellanite	10-15	2	0.3	tertiary	unknown
	25-30	1	1.5	secondary	hard hammer

Artifacts from Level 1 are associated with the natural stratigraphic horizon Level 1, and artifacts from Levels 2 and 3 are associated with natural stratigraphic horizon Level 4 as illustrated in Figure 34 (Profile 7S 21W).

Unit 60S 1W

After consultation with USFS archaeologists, this 1 x 1 meter unit was placed on the small remnant terrace above the intermittent creek in order to check for possible cultural materials in this area of high potential. A shovel probe was excavated at approximately 58S 1W to examine the stratigraphy present on the small terrace next to the 1 x 1 meter unit prior to excavation. This probe produced two flakes (one KRF, 15-20 mm, 0.3 g, tertiary, unknown production; and one chert, 30-35 mm, 2.4 g, tertiary, soft hammer production) from a well-defined black band 10-15 cm BGS.

Based upon the evidence of the shovel probe, the 1 x 1 meter unit was excavated using one 10 cm level to the top of a distinctive dark band. Level 2 consisted of the entire band which was 8-10 cm deep. Level 3 consisted of an arbitrary 10 cm level beneath the bank into sterile clays (see Figure 35). The band present in the 1 x 1 meter unit was amorphous in areas but generally consisted of a blacker color matrix with numerous flecks of charcoal. Flakes, bone, and unworked rock fragments were associated with this distinctive cultural horizon. The artifacts are described below:

<u>Level</u>	<u>Material</u>	<u>Size (mm)</u>	<u>#</u>	<u>Wt (g)</u>	<u>Flake Subcategory</u>	<u>Mode of Production</u>
Level 1 (0-10)	KRF	20-25	2	2.2	tertiary thinning	hard hammer soft hammer
Level 2 (10-18)	KRF	15-20	1	0.5	thinning	soft hammer
	Chert	10-15	1	0.1	tertiary	soft hammer
	Grey por- cellanite	10-15	1	0.2	tertiary	unknown

In addition, 20 unidentifiable small mammal bone fragments (0.9 g) were recovered from the cultural level. Four unworked pieces of baked clay-porcellanite were recovered, with a combined weight of 214.0 g. Six small sandstone fragments totaling 15.4 g were also recovered from the cultural level. In addition, several (ca. 15-20) small petrified wood and scoria fragments were discarded.

Discussion and Analysis

The results of the 1 x 1 meter testing at Site 32MZ334 provided conclusive evidence of a multi-component, stratified site. The cultural horizons were plainly defined by the presence of the buried surface/incipient soil zone on the western side of the current Abraxas roadway. Cultural materials were clearly located above this soil horizon in Units 5N 22W and 0N 23W, in Units 7S 22W and 0N 2W, and within the horizon in Unit 60S 1W.

The cultural stratigraphy east of the current road is not as clearly defined or understood. Soil zones consist of undifferentiated sands and sandy loams of eolian origin. There are no definable cultural strata or soil zones within the profile. The incipient soil horizon from the western site area is conspicuously absent. Cultural materials were present throughout the excavated units between 0 and 40 cm in depth. However, the materials were extremely sparse in all squares excavated. The above discussion is true for Units 14N 0W, 9N 0W, 1N 6W, and essentially true for 47S 13E, although here evidence of soil strata is present but lacking cultural materials. The units are also heavily disturbed by root and rodent activity which can easily displace cultural artifacts up or down in the soil profile.

4.2.3 Comparison to UNDAR-West 1981 Excavations

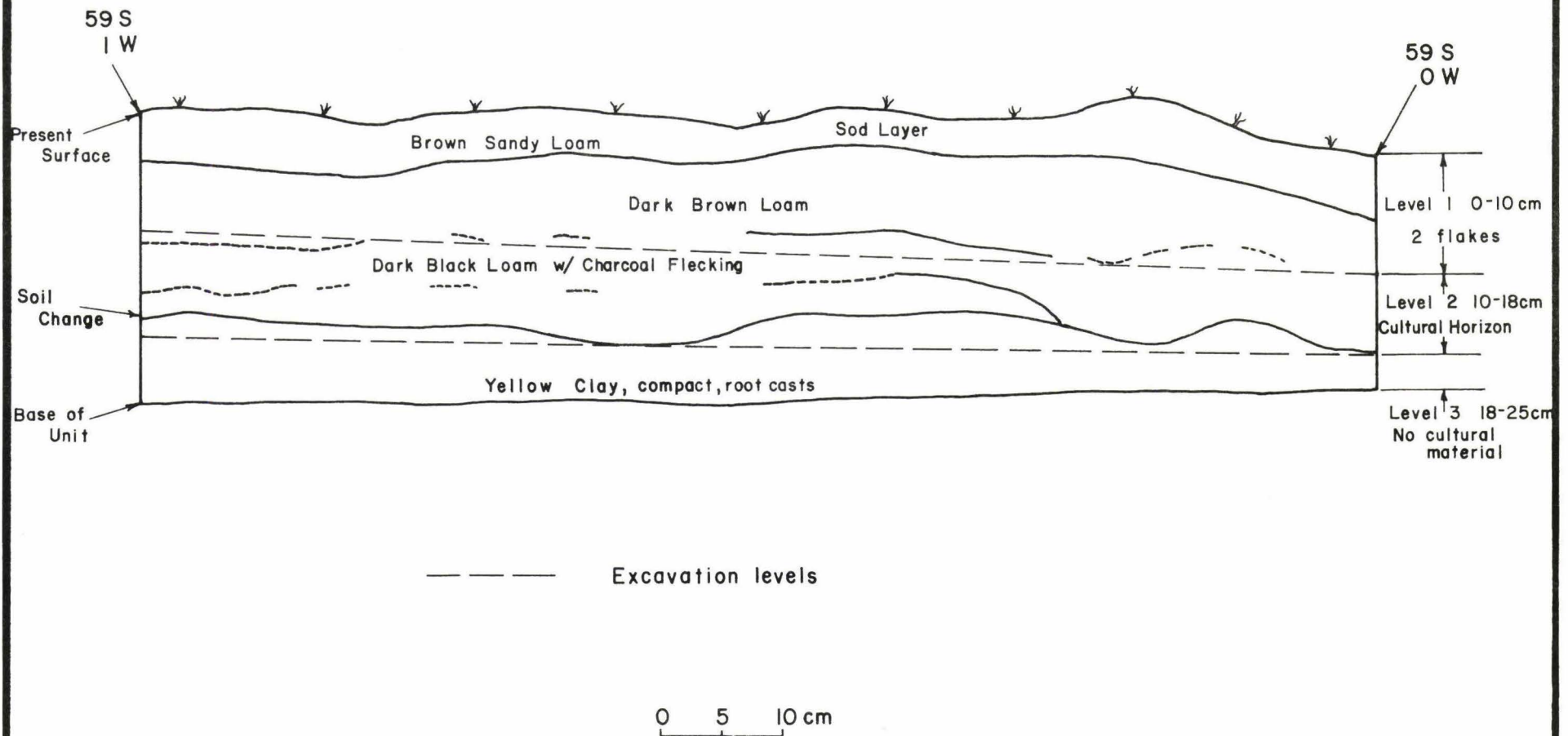
Cultural Horizon 1

The 1981 UNDAR-West excavations were centered on the current bulldozer road right-of-way which is entirely east of the units producing stratified deposits. No test units were placed west of the current roadway. The close resemblance of the surface collection materials and those from the large 3 x 3 meter block excavated around the defined area of the Feature 1 fire hearth appear to indicate that only one component was present at the site. The excavated materials were found primarily 20-30 cm BGS, with about 20 cm of the profile bulldozed away (Borchert, et al. 1982). The stratigraphic profiles do not indicate the presence of a buried soil zone. Materials recovered included flakes of white agate (chalcedony?), chert, grey porcellanite, and unworked igneous and metamorphic rocks.

The excavations and materials from the UNDAR-West report (Borchert, et al. 1982) closely resemble those from the

Figure 35

32 MZ 334
Unit 60 South I West North wall profile



current project east of the roadway. The soil profiles are markedly similar, with massive evidence of bioturbation and probably dislocation of the artifacts' primary context. The greatest number of artifacts were located 20-30 cm deep in Unit 15N 0W which closely compares to the level of Feature 1. The land surface slopes downward to the west due to erosion where the materials are located at about 10 cm BGS, in Unit 5N 22W. However, these materials from Level 1, above the incipient soil zone, are believed to be from the same occupation represented in the UNDAR-West report and the associated Feature 1.

It seems clear, based upon the close resemblance of the observed stratigraphy, the similarity of materials (i.e., chalcedony, KRF, porcellanite, and metamorphic rock), and the lack of the buried soil zone in the profiles east of the roadway, that the uppermost component of the site is the same as that reported by UNDAR-West and located in the units east of the road in the current project work. This cultural horizon is extremely disturbed, with artifacts displaced both up and down in the profile by massive bioturbation, and was largely, if not completely, destroyed by road maintenance activities prior to the 1981 UNDAR-West excavations.

Evidence of this upper cultural horizon was found in six test units of the current project: 5N 22W (Level 1), 0N 23W (Level 1), 15N 0W (all levels), 9N 0W (all levels), 1N 6W (all levels), and 47S 13E (Level 1). The excavation of these units produced only one biface/projectile point tip of KRF (undiagnostic), one secondary core of coarse quartzite, and a total 23 waste flakes from the 1 x 1 block excavations (probe results are not included as the vertical provenience of the artifacts is not known). These are summarized in Tables 32A and 33A.

Because of the sparsity of recovered cultural materials, little can be added from the above information to the existing UNDAR-West report (Borchert, et al. 1982) concerning the nature of this occupation. The current project produced no diagnostic artifacts, datable materials, or cultural features.

The evidence of waste debris indicates that the primary activities at the site consisted of manufacture, repair, and maintenance of stone tools. The activities and duration of occupation were not sufficient to allow attrition

and loss of stone tools. The presence of the fire hearth feature suggests the collection of heat for warmth and/or cooking (bone fragments, some burned, were collected in 1981). All evidence indicates a short-term occupation or hunting camp.

Cultural Horizon 2

This cultural horizon is confined to the southwest portion of the site on a small terrace above the hardwood draw; evidence of this horizon is contained only within Unit 60S 1W. The cultural materials are located within a dark band or incipient soil horizon marked by the presence of black organic staining and charcoal flecks.

Bone fragments, waste flakes, and unworked sandstone and porcellanite chunks were associated within the level. No diagnostic artifacts or datable features were encountered. The cultural remains are again sparse, and little can be determined from the materials recovered in the small probe and 1 x 1 meter unit. The waste flakes are summarized in Tables 31C and 33C.

Seven flakes were recovered from this horizon. Of these, four were KRF (57.1 percent), two were chert (28.6 percent), and one was grey porcellanite (14.3 percent). All were relatively large tertiary or thinning flakes, suggesting manufacture or thinning of existing blanks, rather than reduction from cores. Five (71.4 percent) are tertiary, with two (28.6 percent) being thinning flakes. However, only a small amount of the probable total is represented.

The presence of bone fragments and charcoal flecking suggests domestic activities such as cooking. However, the materials are too sparse for analysis.

The horizon has revealed a promising, well preserved, cultural deposit with excellent potential for further significant buried materials. More testing of the cultural horizon in this area is necessary in order to define the nature and extent of the cultural deposits.

Cultural Horizon 3

This cultural horizon is confined to the area around Units 7S 21W and 0N 23W on the higher terrace above the draw, west of the current road corridor. The horizon was not

present in Unit 5N 22W. The cultural materials are clearly located in the dark brown loam underlying the well-defined, incipient soil zone.

The cultural horizon is characterized by predominant red porcellanite (N=15 or 11.8 percent). The red porcellanite is of poor quality, with many angular chunks and poorly defined flake features. However, they are definitely of cultural origin.

One tool was recovered from the horizon, a retouched flake/scrapper of red porcellanite in Unit 7S 21W. The remainder of the materials consists of waste debris and is summarized in Tables 32B and 33B. The flakes are relatively large tertiary flakes (N=15, 88.2 percent) with only two secondary flakes (11.8 percent). No other cultural materials were encountered.

Based upon the sparse remains from the two units, little can be said of the activities or function of this horizon. Manufacture and/or maintenance of tools is suggested by the waste debris, but more excavation will be necessary to define the nature of the cultural occupations.

Table 32 A

32MZ334 - Horizon 1 Flakes
by Flake Class and Raw Material

	<u>Primary</u>	<u>Secondary</u>	<u>Tertiary</u>	<u>Thinning</u>	<u>Totals</u>
Chalcedony	0	0	5	0	5
Chert	0	0	5	1	6
KRF	0	2	7	0	9
Grey Procellanite	0	0	0	0	0
Red Procellanite	0	2	1	0	3
Totals	0	4	18	1	23
%	0	17.4	78.3	4.3	100

Table 32 B

32MZ334 - Horizon 3 Flakes
by Flake Class and Raw Material

	<u>Primary</u>	<u>Secondary</u>	<u>Tertiary</u>	<u>Thinning</u>	<u>Totals</u>
Chalcedony	0	0	0	0	0
Chert	0	0	0	0	0
KRF	0	0	0	0	0
Grey Porcellanite	0	0	2	0	2
Red Porcellanite	0	2	13	0	15
Totals	0	2	15	0	17
%	0	11.8	88.2	0	100

Table 32 C

32MZ334 - Horizon 2 Flakes
by Flake Class and Raw Material

	<u>Primary</u>	<u>Secondary</u>	<u>Tertiary</u>	<u>Thinning</u>	<u>Totals</u>
Chalcedony	0	0	0	0	0
Chert	0	0	2	0	2
KRF	0	0	2	2	4
Grey Porcellanite	0	0	1	0	1
Red Porcellanite	0	0	0	0	0
Totals	0	0	5	2	7
%	0	0	71.4	28.6	100

Table 33 A

32MZ334 - Horizon 1 Flakes
by Raw Material and Size

Size (mm)	Chalcedony	Chert	KRF	Grey Porcellanite	Red Porcellanite	
0-5	0	0	0	0	0	
5-10	4	1	3	0	0	
10-15	0	1	2	0	0	
15-20	1	2	2	0	0	
20-25	0	2	0	0	1	
25-30	0	0	0	0	0	
30-35	0	0	2	0	2	
Totals	5	6	9	0	3	23
%	21.7	26.1	39.1	0	13.0	100

Table 33 B

32MZ334 - Horizon 3 Flakes
by Raw Material and Size

Size (mm)	Chalcedony	Chert	KRF	Grey Porcellanite	Red Porcellanite	
0-5	0	0	0	0	0	
5-10	0	0	0	0	0	
10-15	0	0	0	0	4	
15-20	0	0	0	1	2	
20-25	0	0	0	1	6	
25-30	0	0	0	0	3	
30-35	0	0	0	0	0	
Totals	0	0	0	2	15	17
%	0	0	0	11.8	88.2	100

Table 33 C

32MZ334 - Horizon 2 Flakes
by Raw Material and Size

Size (mm)	Chalcedony	Chert	KRF	Grey Porcellanite	Red Porcellanite	
0-5	0	0	0	0	0	
5-10	0	0	0	0	0	
10-15	0	1	0	1	0	
15-20	0	0	2	0	0	
20-25	0	0	2	0	0	
25-30	0	0	0	0	0	
30-35	0	1	0	0	0	
Totals	0	2	4	1	0	7
%	0	28.6	57.1	14.3	0	100

5.0 CONCLUSIONS

In this section, the data recovered from our investigations at Sites 32MZ333 and 32MZ334 are integrated and applied to the questions developed in the research design. Each site is treated separately.

5.1 SITE 32MZ334

The testing has defined the presence of three cultural horizons at Site 32MZ334, however, the specific research design questions are not answerable at this time. This is due primarily to the lack of diagnostic cultural artifacts or datable materials, and to the sparse nature of the deposits encountered. The excavations under the current Scope-of-Work were not of sufficient scale to adequately explore the nature and significance of the cultural horizons defined along the western portion of the site area tested, i.e. Horizons II and III.

The upper cultural horizon (I) is basically confined to the eastern portion of the site. It is heavily disturbed and lacks direct scientific information due to the effects of bioturbation and displacement of artifacts from their direct context. The major portion of the site has been destroyed by road construction and was partially salvaged by the UNDAR-West testing program of 1981. Little or no information remains in this portion of the site, and no further work is recommended east of the existing road.

However, Cultural Horizons II and III are confined to the western portion of the site between the terrace edge and the road. Both horizons exhibit the presence of intact cultural deposits and the potential for further significant information. While the specific research questions outlined for the site under the current project research design are not directly answerable from the materials retrieved from the testing program, none of the research questions can at this time be termed as irrelevant or unanswerable for the future. Further work along the lines of the existing research design is necessary to assess the nature and extent of the cultural deposits within the Horizons II and III to adequately assess the site's potential eligibility for the National Register of Historic Places.

Future investigations at Site 32MZ334 should be confined to the terrace west of the existing access road, and concentrated within two areas of the site as defined by the current testing program. The first area is in the vicinity of Cultural Horizon II which is confined to Unit 60S 1W. The testing in this area should be expanded from this excavation unit by using the standard procedures

utilized throughout this project. A series of systematic probes should be undertaken to define the site area and concentrations, with 1 x 1 meter units and layer block excavations as necessary. The cultural horizon exhibits bone, lithic debris, charcoal and a dark staining of the soil matrix, suggesting extremely good potential for further cultural deposits and features in the immediate area.

The second area of concentration is the area of Cultural Horizon III in Units 7S 21W and 0N 23W. Again, the testing should expand from these defined areas to the north and west to determine the extent of the cultural horizon. Further 1 x 1 meter or block units should be opened as warranted. This horizon is located below the incipient soil zone and lacks the dark cultural staining of Horizon II. The exact nature and potential for further significant deposits at this area could not be determined by the current testing program.

5.2 SITE 32MZ333

The research goals at this site are subsumed under categories of depositional history and environmental reconstruction, cultural chronology, site and activity area functions, and technological/economic adaptations.

5.2.1 Site Depositional History and Environmental Reconstruction

Previous investigations at Site 32MZ333 by UNDAR-West in 1981 revealed a complex stratigraphy with multiple components of occupation indicated by cutbank exposures and projectile point styles. Several periods of deposition and erosion were evident from these examinations. One of the major goals of this phase of the mitigation program was the definition of these cut and fill episodes in relationship to the buried cultural deposits present at the site. John Albanese of Casper, Wyoming, served as a consultant to detail the depositional and erosional history of the site. His complete report is contained in Appendix 7.6.

The excavated portion of Site 32MZ333 is situated on the crest of a small local ridge, 24 meters high, bounded by slopes which vary in inclination from 18 to 40 degrees. Base bedrock is the Sentinel Butte Formation exposed on the ridge slopes. Four geomorphic surfaces were defined, the ridge crest and three Holocene terraces, along ephemeral stream channels at the base of the ridge.

Five distinct soil zones serve as chronological markers, labeled from oldest to youngest: P5, P3, P4, P2, and P1. P4 and P2 soils may be of approximately the same age but differ in hue and texture due to the nature of the materials

they formed upon, P4 developing on aeolian sands and P2 in sandy, clayey colluvium.

P5 is the oldest and most mature soil present in the area and is confined to the upper ridge crest. The soil is a dark brown color with a well developed Cca horizon underlying the unit. This soil has been referred to in the text as a paleosol. P4 is the surface soil over the bulk of the main ridge crest and immediately overlies the P5. This soil is eolian in origin and consists of a light brown, weakly developed matrix. Present in the soil are a series of humic bonds, referred to in the text as incipient soils, resulting from burial of a grassy turf by aeolian sands (see Figures 26 and 30, Profile Cuts). The top of P4 is a planar erosional surface which cuts across both the P5 and P4 soils. The soils are thus of variable depth over the site area and are completely removed by truncation along the northeast margin of the ridge (Appendix 7.6, Enclosure No. 3).

The remaining soils, P3, P2, and P1, are associated with the three Holocene terraces labeled T1, T2, and T3, labeled youngest to oldest. The T3 terrace supporting the P3 soil is the most restricted in occurrence (Appendix 7.6, Enclosures 2 and 3). Portions of the T1 and T2 terraces have been removed by relatively recent erosion. The T1 terrace supports the P1 soil and the T2 terrace, the P2 soil (Appendix 7.6, Enclosures 2 and 3). These terrace soils are all located below the ridge crest on the unexcavated portion of the site margins.

Based upon the above information, it is clear that the main excavated site area consists of two defined and well developed soil zones, the P5 and P4. Using these defined soil zones as markers, it is possible to divide the site into three broad cultural horizons. Cultural Horizon I is the oldest and consists of that portion of the profile beneath the P5 soil zone to the Sentinel Butte Bedrock. Cultural Horizon II is the next oldest and consists of the P5 soil horizon. Cultural Horizon III consists of all materials overlying the P5 in the P4 soil zone.

Underlying the P5 soil horizon by five to six cm in depth is a cultural horizon represented by Feature 9. No diagnostic artifacts were associated with this dark, humic stain, but several flakes and bone fragments were recovered. This feature has been dated to 2270±80 B.P., representing Cultural Horizon I.

Cultural Horizon II consists of four fire hearths with associated artifacts, including one Besant style projectile point. These cultural materials were associated with the base of the A2 horizon of the P5 soil (paleosol). The P5 soil developed after these occupations, dated between 2041±

124 B.P. and 1890 ± 65 B.P., indicating that the soil is younger than 1890 B.P. It also suggests roughly a 230-year period of dry deposition between these cultural horizons. The presence of a well-developed A2 horizon on aeolian sand suggests that the soil developed in a relatively "wet" climatic cycle when stable conditions allowed continuous development of a shortgrass sod.

Cultural Horizon III is composed of a fire hearth and associated projectile point fragments, suggesting a Late Prehistoric Period occupation within the P4 soil. The cultural materials were associated within one of the dark humic bands or incipient soil zones. A date of approximately 318 ± 41 B.P. has been accepted for this cultural horizon. This suggests approximately a 1675-year period of non-occupation of the site area. The presence of the P4 soil also suggests a return to drier conditions following the wet cycle in which the P5 soil developed. This dry period has continued with some interruptions, represented by the humic bands/incipient soils, to the modern time period. This is further suggested by the T1-T3 terraces, indicating dry periods when the water table lowered, allowing downcutting and erosion of the stream channels.

Also of particular interest in the cultural occupation of Site 32MZ333 is the presence of articulated bison bone, representing a kill episode preserved on a small remnant of the T2 terrace that abuts against bedrock (see Appendix 7.6, Enclosures No. 2, 3, and 4). Large quantities of bison bone were eroding and present on the surface on the arroyo floor, along with several pieces of flaked stone debris and tools. These were collected by USFS and UNDAW-West personnel. Analysis of the bone (Borchert, et al 1982) suggested the presence of at least four individuals.

Geomorphic and soil relationships indicate that the bison bone is younger than the P5 soil, which formed after the Besant occupation. The bison bones and the time of the kill may be of the same age as the artifacts present on the top of the ridge within the P4 soil dated to 318 B.P. As previously mentioned, the P4 and P2 soils may be of the same approximate age. However, there is no direct tie between the kill episode and the cultural occupations on the ridge crest at this time. Appendix 7.6, Enclosure No. 4, shows the apparent surface configuration at the time of the kill and indicates that no depression pronounced enough to form a bison trap was present. The means of the exact procurement technique are therefore unknown.

The investigations reveal that the ground surface in the vicinity of Site 32MZ333 has undergone pronounced changes since occupation by the Besant people. Much of the original

hill slope adjacent to the ridge on which the Besant campsite is located have been removed. The channels of the ephemeral streams have been downcut some six to 7.6 meters since approximately 1890 B.P.

At the Besant occupation, the ground surface would have been much more undulating than at present, with less pronounced slope angles and swale-like stream channels rather than the deep arroyo-type channels now present. The climate was probably semi-arid as at the present, as indicated by eolian sands on the ridge crest. The Besant occupation was followed by a "wet" period in which the P5 soil formed. This event was followed by more arid conditions, which have continued to modern times with only minor interruptions. Evidence of the latest downcutting cycle is furnished by the six-seven meter deepening of the stream channels (Appendix 7.6, Enclosures No. 3). Interruption in the deepening of the stream channel is affirmed by the creation of the T1 and T2 terraces when depositional processes become dominant. The area is currently being subjected to erosion, and portions of the T1 and T2 terraces are being destroyed.

While the climate and topography at these sites have changed markedly during the course of human occupation, the general vegetational environment seems to have been reasonably stable. The pollen and macrofloral records display the same environmental zones observed at present, although the relative proportions of various taxa have fluctuated. In particular, the variety of pollen taxa increased in the upper levels, possibly in response to the "wet" period in stream downcutting following the Besant occupation. However, the present environment of hardwood draws and sagebrush/grass covered ridges provides a reasonable model for the general Besant environment, when revised to include a more undulating, less dissected ground surface (see Scott, Appendix 7.5).

5.2.2 Cultural Chronology

As noted in the research design, little is known of the exact cultural chronology in this portion of North Dakota. One of the major goals of this project was to collect information concerning the nature of the cultural chronology as represented at Site 32MZ333.

The establishment of a relative chronology, based upon the stylistic dating of each time-diagnostic artifact such as

projectile points and potsherds by associated depositional layer and hearth feature, was not possible. The site produced relatively few projectile points readily identifiable by existing typologies, only one Besant projectile point, and few associated tools to further define the assemblages.

Another goal which the data did not serve was the collection of temporal information from both the top and bottom of each layer in order to determine the rates of sedimentation and lengths of non-depositional episodes. Cultural materials and datable features were confined to one level from the upper eolian soil. Dates were therefore not obtainable from the top and bottom of each layer.

However, absolute dates from each of the cultural horizons defined were obtained through the use of C-14 and obsidian hydration (Table 34) analysis. These dates firmly establish the periods of cultural occupation encountered and the approximate lengths of non-occupational periods. The site produced evidence of occupation from the Late Plains Archaic Period through the Late Prehistoric Period, or approximately between 2270 ± 80 B.P. for Cultural Horizon I through ca. 215 ± 60 B.P. for Cultural Horizon III (Figure 36).

A table of the C-14 and obsidian hydration dates obtained from the site is presented below. Five C-14 samples were submitted to Beta Analytic, Inc. for analysis, and four obsidian flakes were sent to MOHLAB for hydration analysis (Table 34).

Discussion and Analysis

In Cultural Horizon III, dates were obtained from both C-14 and obsidian hydration techniques. The C-14 date of 215 ± 60 B.P. was felt to be possibly 100 years too young due to rootlet contamination (Stipp, personal communication 1982). The obsidian hydration date of 318 ± 41 is therefore believed to be more accurate. In any case, the two dates virtually overlap at 1 SIGMA.

Similarly, the C-14 date of 1400 ± 40 B.P. for Feature 1 in the large 4 x 4 meter block north of the Abraxas road is considered to be too early, possibly due to contamination of the sample. Again, the obsidian dates of 2041 ± 124 and 2006 ± 52 B.P., are believed to be more accurate, based on the nature of the relative stratigraphy of Cultural Horizon II over the site area. Features 1, 3, 5, 7, and 8 were all

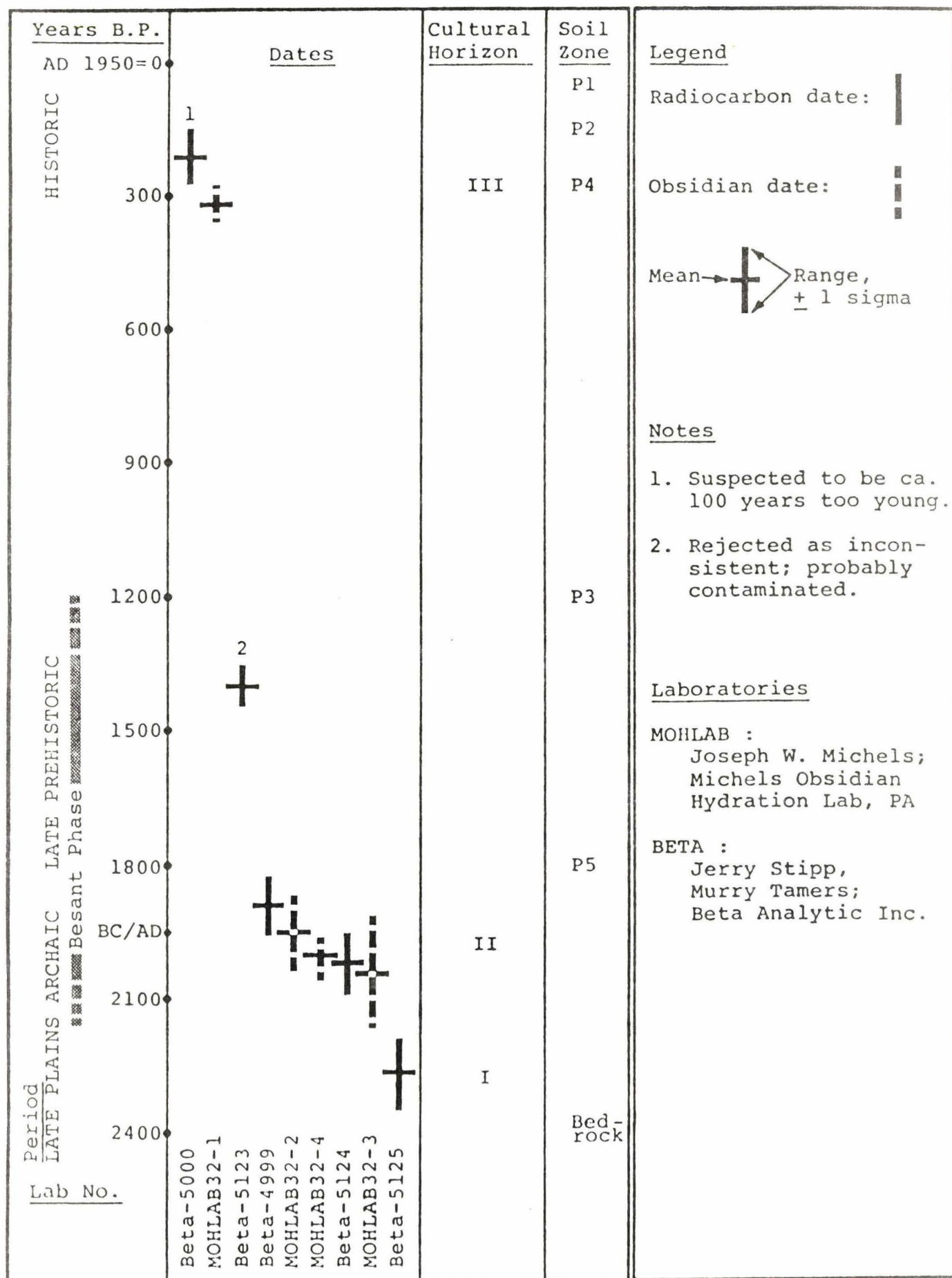
Table 34. Summary of Dates, 32MZ333

<u>Cultural Horizon</u>	<u>Years BP</u> ¹	<u>Years BC/AD</u>	<u>Material</u>	<u>Lab No.</u>	<u>Associated Feature</u>
III	215+60 ²	AD1735+60	C-14 (charcoal)	Beta-5000	4
	318+41	AD1632+41	Obsidian	MOHLAB 32-1	4
II	1400+50 ³	AD550+50	C-14 (soil)	Beta-5123	1
	1890+65	AD60+65	C-14 (charcoal)	Beta-4999	8
	1954+87	4BC+87	Obsidian	MOHLAB 32-2	7
	2006+52	56BC+52	Obsidian	MOHLAB 32-4	1
	2020+70	70BC+70	C-14 (soil)	Beta-5724	7
	2041+124	91BC+124	Obsidian	MOHLAB 32-2	1
III	2270+80	320BC+80	C-14 (soil)	Beta-5725	9

Notes

1. All dates use AD 1950 as present. All radiocarbon dates are based on the Libby half-life figure of 5568 years (Appendix 7.1). All obsidian dates assume correct identification of material source as Obsidian Cliff (Appendix 7.2).
2. This date is suspected to be young by up to ca. 100 years, due to possible remnant rootlet contamination (Stipp, personal communication 1982). If so, it would almost exactly duplicate the associated obsidian date.
3. This date is rejected on grounds of conflict with stratigraphically associated radiocarbon and obsidian dates. This sample is suspected to have been contaminated by rodent burrowing.

Figure 36. Absolute Date Chronology, 32MZ333



located in the same stratigraphic context at the base of the Level 3 paleosol (soil P5, Albanese, Appendix 7.6). A firm date of 1890 ± 60 B.P. is recorded for Feature 8. Similarly, firm dates of 2020 ± 70 B.P. by C-14 and 1954 ± 87 B.P. by obsidian hydration have been obtained for Feature 7. Therefore, it appears that Feature 1 and the associated Besant point and artifacts, located at the same stratigraphic position within the site area, are approximately the same age. The obsidian dates of 2041 ± 124 and 2006 ± 52 are believed to be more representative of this probable association than the C-14 date of 1400 ± 50 , which seems much too young.

5.2.3 Site Function and Activity Areas

Attempts to identify activity areas within each block area excavated and to assign a site function have been discussed. These will be only briefly summarized for each cultural horizon. Activity areas were denoted by plotting concentration and density of the artifact classes over the site to identify the focus of human activity. The material remains were then analyzed and interpreted to determine the activity responsible for the production of these artifacts.

Cultural Horizon I

This cultural horizon was represented by Feature 9 and was encountered only in units 34-36S 3-5W (Figure 24, planview). The materials recovered included only seven pieces of debitage and 41.9 g of small unidentifiable bone fragments. All cultural materials were confined to the large black loam stain.

The dark stain extended 2.3 meters east-west and 1.5 meters north-south. The cross-section of the stain revealed a broad, shallow basin, five-six cm deep. The fill was a distinct dark black at an average 32 cm below surface. Macrofloral analysis revealed burned and unburned Chenopodium seeds (Scott, Appendix 7.5). Small flecks of charcoal were contained within the fill. A sample of this feature fill was submitted to Beta Analytic for C-14 analysis, and dated at 2270 ± 80 B.P.

The nature and function of Feature 9 is not clearly understood. The sparse nature of the cultural remains makes analysis of the activities impossible. The feature is believed to be the result of cultural development and staining

of the matrix. It is also possible the stain represents the remains of a small, short-term habitation structure of brush or skins which may have burned to the ground. However, no evidence of postholes or hearth features was encountered. The bone fragments were not burned.

Cultural Horizon II

This cultural horizon was encountered in all units excavated at Site 32MZ333. It consists of the base of the A2 horizon of the distinct paleosol (P5 soil zone) present over the entire upper ridge site area. A series of distinct cultural occupations is associated with the base of this paleosol, represented by four distinct fire hearth features, one roasting pit feature, and associated scatters of lithic debris. The dates of these occupations range from 2041±124 B.P. to 1890±60 B.P. Each of these areas is discussed below.

The remains of the densest, most prolonged occupation of this cultural horizon occurred within 4 x 4 unit 0N 3S 1E 2W. A total of 3,247 pieces of flaked stone were recovered from these units, associated with a distinct fire hearth (Feature 1), roasting pit (Feature 3), and three small stains containing lithics and bone resulting from hearth-cleaning activities. This component has been identified as Besant, based on the recovery of a Besant-style projectile point base (Figure 15a) from Feature 1.

Some faunal remains identified from this area represent Bison bison. However, most of the bone fragments could be identified only as large mammal or small mammal (Chomko, Appendix 7.4). Several of these fragments are burned and charred. The bone fragments are directly associated with the Features 1 and 3 and the stained, hearth-cleaning dump areas. This association definitely suggests food preparation. In particular, the small size of the fragments may represent the results of bone grease/butter manufacture (Chomko, Appendix 7.4; Vehik 1977).

Macrofloral analysis of Feature 1 was inconclusive (Scott, Appendix 7.5). The hearth contained burned and unburned grass seeds; and unburned twigs, catkins, bud tips, and insect fragments. No distinct carbonized seeds, other than grass, assignable to the occupation were recovered, suggesting that plant gathering was not a major site activity.

Analysis of the stone tools implies that the latter stages of tool manufacture and maintenance were conducted at the site. This is indicated by the dominance of small (less than 15 mm), tertiary, pressure flaked debris. Manufacture is suggested by the blanks and biface fragments as well as the thinning flakes. The manufacture/repair of these stone tools was obviously a major site activity.

Figure 14 represents the density distribution of the flaked stone debris which indicates that the activities were associated with the areas around Feature 1 and extending south to the edge of the block unit, with little debris to the north. The biface fragments and the waste debris are plainly associated with the vicinity of Feature 1. The presence of the scraper from the same area suggests hide scraping; however, only one scraper was found, although several of the utilized flakes appear to have been used in a scraping motion.

The presence of hearth and roasting pits with the associated hearth-cleaning dumps suggests a stay of some duration, as does the density of flaked stone debris. The projectile point, scraper, and biface fragments, as well as the dominance of flaked debris indicating manufacture/repair of stone tools, suggests a hunting base camp. The duration of the stay appears to have been longer than that for the other activity areas present.

The 4 x 4 meter block south of the road is considered as two separate activity areas: that associated with Features 5 and 8 in 33-36S 2-5W, and that associated with Feature 7 in 28-29S 5-6W.

One hundred twenty pieces of flaked stone were associated with the vicinity of Features 5 and 8: four tools and 116 pieces of debitage. Features 5 and 8 represent fire hearths in very close proximity (Figure 18). The contemporaneity of the features has not been established, however, there is no way to separate the associated lithics surrounding the features. The density of the flaked stone is presented in Figure 21. Feature 8 is dated 1890±65 B.P.

Faunal remains are primarily unidentifiable large and small mammal bones, some charred. Bison bone was identified from the assemblage (Chomko, Appendix 7.4).

Macrofloral analysis of Feature 8 produced no seeds, some burned twigs, and burned and unburned grass fragments. Only burned and unburned grass was found in Feature 5 (Scott, Appendix 7.5). The results are inconclusive but reveal no evidence of plant gathering activities.

The scatter of sparse lithic materials is confined principally to the north and west of the features; density of debitage surrounding the features is low (Figure 21). No diagnostic artifacts were recovered.

Analysis of the flaked stone debitage suggests reduction of secondary flake blanks to finished pieces on a small scale, based on the small amount of debitage present. The presence of flakes representing all three modes of production suggests the manufacture and maintenance of a broad variety of tools.

Thirty-one pieces of debitage and four tools were associated with the Feature 7 hearth, dated to 2020±70 B.P. (see Figure 20). The highest concentration occurred west of the feature.

Analysis of the bone indicates use of antelope: 22 identifiable antelope bone fragments were recovered, representing a charred foot from a single individual, as well as several ULM and USM fragments (Chomko, Appendix 7.4).

Macrofloral analysis of Feature 7 revealed only burned and unburned grass pieces (Scott, Appendix 7.5).

Analysis of the flaked stone suggests both tool use and lithic reduction occurred around Feature 7, although on a more limited scale than that surrounding Features 5 and 8. Of interest from Feature 7 is a small biface/point preform (Figure 22c). This piece is indicative of a much later occupation. The artifact resembles unnotched points of the Late Prehistoric Period or a preform for a side-notched point type of the same period. A date of 2020 B.P. seems old for this specimen. However, the artifact is clearly associated and non-intrusive, since it was recovered in two pieces, from two separate units both in Level 3 surrounding Feature 7.

The remains of another distinct occupation during the same relative time period were recovered from units 11-12N 59-61W. No features or datable material were recovered from this zone; however, the occupation is from the same stratigraphic position at the base of the P5 paleosol and is believed to be of similar age as the other dated occupations.

One untyped projectile point was recovered (Figure 22a). As the dates for this horizon range within the Late Archaic-Besant time frame, the point is believed to represent a Late Archaic dart-type point. Besant points with similar features, including concave bases, were reported at Whiskey Hill-23DW1001 (Johnson 1977, Figure 4G), in association with Woodland pottery. This will be discussed in a later section. The uncorrected date for Whiskey Hill is 1550±60 B.P.

Faunal remains are mainly ULM fragments, and no analysis was possible (Chomko, Appendix 7.4; Scott, Appendix 7.5).

Relatively few artifacts were associated with this area. The flakes were generally large, with few secondary and primary flakes, indicating the latter stages of manufacture. The small pressure flakes usually associated with the other activity areas discussed were lacking. Some thinning flakes were present indicating manufacture of or from blanks. This area has been largely destroyed by erosion, and larger areas need to be examined to define accurately the cultural area. Other artifacts were recovered from the paleosol unit in other excavation units but were sparse and non-diagnostic.

All of the features and materials discussed above were encountered within or at the base of the paleosol P5. The features are dated between 2041±124 and 1890±70 B.P. This fits well into the Late Plains Archaic time period (Frison, 1978). Further, points from Feature 1 and 11N 59W suggest a strong association with the Besant culture.

The presence of multiple features and associated activity areas suggests the site was revisited on a number of occasions over a period of time. The site was probably re-occupied over time by the same local group of people, a concept discussed by Johnson (1977). Such a group is defined as one which exploits, and is adapted to, conditions in a specific geographic area or region (Johnson 1977, pp. 38-39).

All of the activity areas suggest short-term hunting camps. With the exception of the area around Feature 1, these occupations were of extremely short duration with few remnant materials left behind. The area surrounding Feature 1 suggests a longer duration, affirmed by the dense flake debris, larger numbers of flaked stone tools, roasting pits, and hearth-cleaning remains.

The material remnants of these occupations indicate that tool manufacture and maintenance was a dominant activity, usually centered around the fire hearth features. Animals utilized include both large and small mammals with bison and antelope identified. The gathering of plants and their utilization does not seem to have been a dominant activity, based upon the lack of macrofloral remains in the features, and of artifacts associated with plant utilization, e.g., ground stone.

The evidence suggests a series of short-term hunting camps used for only one or two nights; a longer stay is suggested for the area of Feature 1. The seasonality of these occupations is unknown. However, late spring to fall occupation of these ridge top sites has been suggested by other researchers in the area (East et al. 1981). There is no evidence of permanent or semi-permanent dwellings.

Cultural Horizon III

Cultural Horizon III encompasses all of the P4 soil defined by Albanese which includes the light-brown aeolian deposits overlying the paleosol (P5). A discontinuous scatter of materials was recovered from Levels 1 and 2 in several of the units. This includes the modern sod and the intervening layer between the sod and the paleosol. The artifacts were few and they may represent either a distinct occupation zone or the results of scatter up and down from the defined cultural horizons. These artifacts are, therefore, not included in this discussion, but have been previously described. The only defined cultural occupations considered here are from Profile Cuts 1 and 2. Although these units have not been definitely established as contemporaneous, they are discussed together as one horizon below.

The cultural occupation surrounding Feature 4 has been dated to 318 ± 41 B.P. by obsidian hydration (Appendix 7.2). A total of 616 pieces of flaked stone were associated with this cultural horizon. Three were tools, the remaining 613 were classified as debitage. None of the artifacts were diagnostic; however, two point tips/biface fragments indicative of Late Prehistoric arrow points were recovered. This was later confirmed by the dates. Associated with this horizon were two features: one distinct fire hearth (Feature 1), and one small stain of fired earth (Feature 6).

Faunal remains from this area include bison (Chomko, Appendix 7.4); however, most of the bone fragments are ULM or

USM, some of which are charred. The bone fragments are directly associated with the features, notably southwest of Feature 4, and suggestive of food preparation or bone grease/butter manufacture (Chomko, Appendix 7.4; Vehik 1977).

Macrofloral analysis of the fill from Feature 4 revealed a variety of seeds. Unburned seeds of *Atriplex*, *Chenopodium*, *Graminae*, *sporobolus*, *malva neglecta*, and *rumex* were noted. In addition, unburned insect segments, snail shells, bud tips, as well as burned and unburned grass and twig fragments, were recovered. This contains many times the number of taxa (although uncarbonized) present at the features from Cultural Horizon II.

The flaked stone tools were definitely associated with the area of Feature 4, to the northeast of the hearth (Figure 28). Analysis of the flaked stone debitage clearly indicates that tool manufacture/maintenance was the dominant activity at the site. The manufacture was limited to the latter stages and final shaping and/or sharpening, rather than the entire lithic reduction sequence. This is clearly indicated by the dominance of small, tertiary pressure flakes and the lack of larger primary and secondary flakes.

Of particular interest in the study of this cultural horizon is the presence of a bison kill episode located northwest of the site area at the base of the deep draw. At least four individuals are represented in this kill (Borchert et al. 1982). A geomorphic study of this area by John Albanese (Appendix 7.6) has demonstrated the association of this kill episode to the Late Prehistoric Period rather than to the earlier Late Plains Archaic occupations of Horizons II and I.

In addition, Albanese has suggested that the soil of the T2 terrace (P2) in which the bone is located may indeed be of the same age as the P4 soil containing the Late Prehistoric occupation detailed above. This provides a strong circumstantial case for contemporaneity of these two events, as does the presence of large amounts of cracked bison bone associated with Feature 4. However, the relationship between these two events has not been determined.

5.2.4 Technological/Economic Adaptations

Intra-Site Comparison

The range of technical activities through time at the site can be investigated by study of each artifact class for

material type and source, stages of lithic reduction, and method of manufacture. A study of the technical activities may help to explain the availability of and/or preference for lithic raw materials over time and the role of local vs. imported materials.

Raw Material Utilization

The raw material utilization for each cultural horizon and activity area locus described is summarized in Tables 35, 36, and 37. Table 35 summarizes the debitage by raw materials, total number and percent of the total tool collection. Table 37 summarizes the raw material totals for both debitage and tools by count and percent.

Table 36 shows that for each cultural horizon defined at Site 32MZ333, the dominant raw material is Knife River Flint. KRF represents the greatest proportion of the total in Cultural Horizon II, 83.7 percent; next largest in Horizon I, 57.1 percent; followed by Cultural Horizon III at 50.2 percent of the total raw materials present. It should be noted that since only seven artifacts were present in Horizon I, the material utilization may actually be skewed and not a truly representative sample. Within Cultural Horizon II, KRF is dominant in each of the activity area loci defined, ranging from 85.3 percent at 34-37S 2-5W (F-5, F-8) to only 48.4 percent at 28-29S, 5-6W (Feature 7).

Other raw materials occur in limited numbers at each of the cultural horizons and activity areas. Grey porcellanite is second within Cultural Horizon I at 42.9 percent (only N=3, however). Grey porcellanite is third within Cultural Horizons II and III with 2.4 percent and 16.7 percent, respectively. Second in these cultural horizons is chalcedony: 33.0 percent at Horizon III and 10.7 percent in Horizon II. Grey porcellanite and chalcedony are present in each activity area in Horizon II although variable in frequency. The remaining raw materials are of minor significance and none are present within each activity area or cultural horizon which indicates their relatively low importance to the total cultural assemblages.

The same dominance of KRF is reflected in both the tool assemblages and the debitage present; see Table 5 for Cultural Horizon II. There are no tools present in Cultural Horizon I. The majority of the tools (80.5 percent) from Cultural Horizon II are KRF. KRF is dominant in each of the

Table 35 Raw Material Utilization at 32MZ333

Number and Percentage, Debitage Only

	Knife River Flint		Grey Porcellanite		Red Porcellanite		Chert		Obsidian		Petrified Wood		Chalcedony		TRSS		Quartzite	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Cultural Horizon I	4	57.1	3	42.9														
Cultural Horizon II Total	2852	83.7	78	2.3	5	0.15	47	1.4	46	1.3	13	0.38	365	10.7	2	0.06	1	0.03
ON 3S 1E 2W (F-1, F-3)	2709	84.0	59	1.83	1	0.03	40	1.24	45	1.40	13	0.40	358	11.1				
34-37S 2-5W (F-5, F-8)	99	85.3	4	3.4	1	0.9	7	6.0					3	2.6	1	0.9	1	0.9
28-29S 5-6W (F-7)	15	48.4	10	32.3	3	9.7			1	3.2			1	3.2	1	3.2		
11-12N 59-61W	29	76.3	5	13.2									3	7.9				
Cultural Horizon III	309	50.2	101	16.4			1	0.2	1	0.2			203	33.0				

Table 36 Patterned and Unpatterned Tools,
Number and Percentage of Total Tool Collection

	Knife River Flint		Grey Porcella- nite		Chert		Petrified Wood		Chalcedony	
	#	%	#	%	#	%	#	%	#	%
Cultural Horizon I	-	-	-	-	-	-	-	-	-	-
<hr/>										
Cultural Horizon II Totals										
Patterned Tools	16	44.4	3	8.3	1	2.8	1	2.8	1	2.8
Unpatterned Tools	13	36.1	1	2.8						
0N-3S 1E-2W	8	33.3	2	8.3	1	4.7			1	4.7
Patterned										
0N-3S 1E-2W	12	50.0								
Unpatterned										
34-37S 2-5W	3	75.0					1	25.0		
Patterned										
34-37S 2-5W	-	-	-	-	-	-	-	-	-	-
Unpatterned										
28-29S 5-6W	2	50.0	1	25.0						
Patterned										
28-29S 5-6W	1	25.0								
Unpatterned										
11-12N 59-61W	3	75.0								
Patterned										
11-12N 59-61W			1	25.0						
Unpatterned										
<hr/>										
Cultural Horizon III										
Patterned	1	33.3	2	66.6						
Unpatterned	-	-	-	-	-	-	-	-	-	-

Table 37 Total Raw Material
Counts and Percentage, Tools and Debitage

	Knife River Flint		Grey Porcellanite		Red Porcellanite		Chert		Obsidian		Petrified Wood		Chalcedony		TRSS		Quartzite	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Cultural Horizon I	4	57.1	3	42.9														
Cultural Horizon II Totals	2881	83.6	82	2.4	5	0.15	48	1.4	46	1.3	14	0.4	366	10.6	2	0.06	1	0.03
0n-3S 1E-2W (F-1, F-3)	2729	84.0	61	1.9	1	0.03	41	1.3	45	1.4	13	0.4	359	11.05				
34-37S 2-5W (F-5, F-8)	102	85.0	4	3.3	1	0.83	7	5.8			1	0.83	3	2.5	1	0.83	1	0.83
28-29S 5-6W (F-7)	18	51.4	11	31.4	3	8.6			1	2.9			1	2.9	1	2.9		
11-12N 59-61W	32	78.0	6	14.6									3	7.3				
Cultural Horizon III	310	50.2	103	16.7			1	0.2	1	0.2			203	32.8				

activity area loci ranging from 83.3 percent at 0N 3S 1E 2W to 70 percent each at the other three loci defined. Grey porcellanite is second with 11.1 percent of the tool assemblage in Cultural Horizon II. Following are chert, petrified wood, and chalcedony with 2.8 percent each.

At Cultural Horizon III, grey porcellanite is the dominant tool raw material (66.6 percent), followed by KRF (33.3 percent). However, it must be noted that only three tools are present in the Cultural Horizon III assemblage and may not be a representative sample. Indeed, the total number of tools over the entire site area is extremely small and may not be representative of the preferential raw materials for each tool category. Due to the scarcity of tools within the assemblages, comparisons of the tool kits present and how these subassemblages are reflected through time were not attempted. An examination of the debitage gives the most representative comparison between the raw materials as to preference and utilization. This is noted by comparing the frequencies present in Table 34 with those of Table 36. Generally, the preferred raw material through time at Site 32MZ333 remained fairly stable: KRF, chalcedony, and grey porcellanite with other materials present only secondarily. This suggests predominant reliance on local vs. imported raw materials.

Stages of lithic reduction and the corresponding modes of production at each activity locus within each cultural horizon have been discussed in some detail previously and need not be reiterated here. It is sufficient to say that the major activities of manufacture and maintenance/repair are present at each of the site localities and at each cultural horizon. The presence of thinning flakes and tertiary flakes suggests the latter stages of manufacture, while the small tertiary pressure flakes indicate the final stage of retouch and/or resharpening. The relative frequency of these types of material has been discussed earlier. The occurrence of cores, primary and secondary flakes at each area is relatively low, suggesting that the initial working of cores and the total sequence of lithic reduction were not conducted here. Activities at these sites were centered on the working of existing blanks and tools.

While it is true that specific techno-complexes should be identifiable through time and space, the results of the intra-site comparison from Site 32MZ333 have shown little variations in the cultural horizons representing the Late

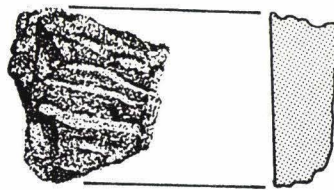


Figure 37
Ceramic Sherd

Plains Archaic and Late Prehistoric time periods. This is, however, not unusual or unexpected. The cultural horizons and activity loci discussed all served a similar function as temporary camps for hunting groups seeking large mammals (bison and antelope) and smaller unidentified mammals. The similarity of the various assemblages may therefore mean that the required technological level and skills necessary for this type of activity have remained stable through time. The same results were found by Aivazian (1981) in comparing the various activity areas at Site 32BI272 representing Middle Plains Archaic (1300 B.C.) through Late Prehistoric Periods (A.D. 860).

Ceramics at Site 32MZ333

No pottery sherds were recovered from the areas excavated in the 1982 investigations; a single potsherd (Figure 37) was recovered on the surface of the road cut within the backdirt of the UNDAR L-shaped original test units 1a, 3a, and 4a (see Borchert et al. 1982, Figure 3). Our Test Unit 25S 7W was placed in close proximity to these units (Map 1), but no ceramics and few lithics were recovered.

Eight body sherds were recovered by UNDAR-West Units 1a, 3a, and 4a; all were grit tempered. Also recovered was a small KRF corner-notched projectile point exhibiting severe attrition and resharpening (Borchert, et al. 1982). On the basis of these artifacts a probable Plains-Woodland component at the site was hypothesized.

Based upon the importance of these nine sherds in interpreting the culture-history of Site 32MZ333, the sherds were submitted to Dr. Ann Johnson for further analysis. The results of this analysis comprise Appendix 7.3.

The sherds appear to be from a single vessel and have been verified as representing the Plains-Woodland tradition. Rim shape and decoration are important criteria for distinguishing between different taxonomic units. However, none of these portions of the upper vessel are present in the collection. The sherds were classified as representing the same component as the Besant projectile point recovered from Feature 1 (Johnson, Appendix 7.3).

The occurrence of Besant-style projectiles associated with Woodland pottery is not unusual in North Dakota and Montana (Wood 1956, Wood and Johnson 1973, Johnson 1977). A brief discussion of similar sites follows.

Site 32MZ2 is a Woodland site located on a flat-topped promontory about 2.5 miles southwest of Williston, North Dakota, on the south bank of the Missouri River in McKenzie County. The promontory is covered with bone 16 to 18 inches below the surface and deeper layers of ash, bone, and flakes. Projectile points are two types: side-notched near the base and apparent corner-notched specimens. The points are readily classifiable as Besant, although not so designated by Wood. This affinity, however, was stated in Wood and Johnson (1973). Projectile points and scrapers are of KRF. Affiliations with the Valley focus on the Central Plains and with the Manitoba focus on the Headwaters Lake aspect of Canada were suggested (Wood 1956).

Site 34DW1001, the Whiskey Hill site, is located in Dawson County, Montana, 40 miles west of the North Dakota-Montana state line and 45 miles south of the Missouri River, in a badlands setting. A cultural horizon two to three inches thick contains pottery, chipped stone, cracked bone, ash, charcoal, and fire-cracked rock. Artifacts associated with the site are nine pieces of pottery and five corner-notched projectile points. The pottery is identified as Woodland Tradition and the points as Besant (Johnson 1977). The unexcavated site was dated to 1550±60 B.P. or A.D. 400.

High Butte (32ME13) is a pottery-bearing, seasonal occupation site in the Missouri River Valley, Mercer County, North Dakota, radiocarbon dated to A.D. 350±140 years. An arc of depressions surround a complex central figure defined as a turtle cult effigy (Wood and Johnson 1973). The projectile points are defined as Besant, and the pottery as Plains-Woodland. An earthen mound, Site 32MZ103, lies one quarter mile to the south. Ninety percent of waste debris and 91 percent of stone artifacts are KRF. Porcelanite (natural brick) is the second most common raw material. Food preparation (bone grease) and hide preparation were major site activities.

Based upon these and similar sites in North Dakota, South Dakota, and Montana, Johnson (1977) considers the distinction between Woodland and Besant as spurious and has placed them within the same cultural tradition. The distinction between pottery as definitive of Woodland sites and projectile points as Besant sites simply emphasizes different aspects of the same material culture in her view.

It is, therefore, reasonable to place Cultural Horizon II of 32MZ333 into the Plains Woodland tradition based upon

the presence of pottery and the identified Besant point, as well as the untyped point from 11N 59W which is similar to the Whiskey Hill points. Lacking, however, from Site 32MZ333 is a direct tie between the pottery sherds recovered and the defined activity areas of Cultural Horizons II.

Some confusion as to the provenience of the sherds arises from close inspection of the UNDAR report (Borchert et al. 1982). The profiles show the cultural horizon as Level 2, while the table of listed artifacts places them in Level 1. In addition, the profile drawings are confusing and possibly in error. Consultation with USFS archaeologist Walt Allen (1982) has definitely placed the sherds within the dark paleosol (P5). However, exact placement of the artifacts within the paleosol, top or bottom, is lacking.

The dated components from the base of this paleosol (Cultural Horizon II) range in age from 2041 ± 124 B.P. to 1890 ± 60 B.P. or 91 B.C. to A.D. 60. A hypothetical correlation of the pottery with the base of this level would by association date the ceramics to the same time period.

A table of dates for selected Woodland sites on the Northern Plains is presented in Wood and Johnson (1973, Table 4, p. 71). The dates for these sites range between A.D. 90 ± 50 (32BA1) and A.D. 1300 ± 200 (39DW290). Most of the Woodland dates fall between A.D. 150-900 (Johnson 1977). A table of dates for Besant in Montana (David 1982) shows a much wider range.

If the ceramics from Site 32MZ333 in Cultural Horizon II are indeed associated with the base of the P5 paleosol, the ceramics may be among the oldest yet found for Woodland-Besant sites, as the dates range from 91 B.C. ± 124 to A.D. 60 ± 60 . The latter date is not unreasonable for the Woodland sites previously dated. However, as no dates were obtained from the top of the paleosol, it is possible that the pottery is younger than the dates above would indicate. The length of time for the prairie sod accumulation of the P5 paleosol is unknown.

Future work in the area of the recovered pottery is necessary to determine the correlation of the pottery with the known and dated activity areas of Cultural Horizon II, to obtain a direct C-14 date for any pottery present, and to enlarge the pottery sample, in particular to recover sherds

from the upper vessel needed for classification to exact taxonomic units. However, the potential for this work may be severely restricted due to the earlier disturbance to the road. The test units from 1981 which contained the most pottery sherds were Units 1a and 4a extending northward into the disturbed and removed portion of the road corridor (Borchert et al. 1982). Since no pottery was recovered in 1982, it is possible the pottery-bearing horizon was very localized and may well have been destroyed during earlier road disturbance activities.

Cultural Horizon II at Site 32MZ333 has been identified as a Besant-Plains Woodlands manifestation dating between 2041±124 and 1890±60 B.P. Similar Plains Woodland-Besant sites have been briefly discussed, as well as accepted dates for Woodland manifestations in the Northern Plains. Besant sites in Montana (Davis 1982) show a wide range: 1100±110 B.P. at the Antonson Site (24GA660) to 2820±120 B.P. at the Jarrett Site (24SW651).

Besant was originally reported at the Mortlach Site (Wettlaufer 1955) and later at the Long Creek Site (Wettlaufer 1960); ceramics were not associated with either. The sites were radio-carbon dated to A.D. 375. Besant manifestations in the Northwestern Plains are distinguished by an extremely sophisticated bison hunting complex (Frison 1978). The development of pounds or corrals and the use of shamanistic or ritual activities at kill sites is evidenced at the Ruby Site (48CA302) dated A.D. 150 and A.D. 280 (Frison 1978). The Muddy Creek Site is another Besant phase site from Wyoming dated at A.D. 320.

Evidence of these highly developed and complex bison hunting sites associated with Besant is missing from the immediate area of the North Dakota badlands. Site 32BI22, Sunday Sage Site, was excavated by UNDAR-West (Simon and Borchert 1981a). Projectile points from the site indicate the presence of Middle Plains Archaic McKean techno-complex, Late Plains Archaic Pelican Lake and Besant techno-complexes, and a subsequent Late Prehistoric Period occupation. The site is non-stratified.

The Besant occupation was identified on the basis of diagnostic projectile points present at the site. A date of A.D. 290-320 was obtained from Feature 1 which compares favorably with the Besant occupations (Simon and Borchert 1981a), although the four defined Besant points were not directly associated with the feature. The predominant raw material at the site was KRF (57.3 percent), followed by

petrified wood (26.5 percent), porcellanite (8.2 percent), and quartzite (5.7 percent). Other secondary material was present.

Of particular interest was the recovery of two grit tempered potsherds indicating a ceramic industry. The pottery was not identified as Woodland (Simon and Borchert 1981a).

32BI22 was believed to represent a short-term hunting camp exemplified by multiple occupations that were non-stratified. No evidence of permanent settlement was found. Articulated bison bone in a nearby draw was not associated directly with the site, and there is no evidence of a deliberate kill (Simon and Borchert 1981a).

Prehistoric ceramics are rare in the Little Missouri Badlands, and little is known of their original use. One small ceramic specimen was also recovered from 32BI21, the Anderson Coulee Site (Fox 1981). The piece was extremely small and represented a split body sherd exhibiting a smooth, buff-colored surface finish. The dark black clay nearby contained crushed granitic temper. No dates or diagnostic projectile points were recovered from the site. Based upon the pottery, a date from Besant to protohistoric times was inferred (Fox 1981). Again, KRF was predominant in the assemblage (51.3 percent), followed by agate (26.6 percent), porcellanite (4.8 percent), chert (6.3 percent), and other materials (11 percent). The site was believed to represent a single occupation of short duration, possibly a hunting camp.

Investigators at Site 32BI136, the Government Creek Site, recorded about 36 sherds of both decorated and plain pottery. This ceramic and lithic site was described as containing two components: one with about 25 sherds of well made, incised and punctated pottery identified as Plains Woodland type, and a second area with 11 sherds of crude, friable, and undecorated pottery. Discrete concentrations of butchered mammal bone were present in both areas. The pottery and the relatively high ratio of finished tools to flakes at the site indicate a meat processing site of the Late Prehistoric period (Lau 1981).

A probable Plains Woodland component was identified at 32MZ257B (East et al. 1981). A radiocarbon date of A.D. 670±90 was recovered from a salvaged fire pit in the roadway. Associated with the fire pit was a dense scatter of lithic materials; no pottery was recovered. A total of

535 lithic artifacts, predominantly KRF, were recovered from 32MZ257. The site, as well as others from Cinnamon Creek River, was labeled as a "transitory camp" of unknown function of probably late spring to early fall occupation.

For the time period under discussion for Cultural Horizon II at 32MZ333, it is evident that the materials from 32MZ333 and other sites within the Little Missouri Badlands are very limited, temporary camps, and represent only a narrow segment of the total cultural manifestation represented within the Plains Woodland-Besant techno-complex. Large, complex bison pounds with ritualistic overtones are associated with Besant at the Ruby Site (Frison 1978), and a more sedentary type of existence is present along the Missouri River trench at 32ME13 (Wood and Johnson 1973). The sites from the Little Missouri Badlands are part of larger cultural systems and seem to represent small, highly specialized components of these larger cultural systems adapted to hunting and resource utilization of the Little Missouri Badlands area. Study of these smaller manifestations of the larger cultural complex is necessary to understand the entire socio-economic framework of the prehistoric inhabitants.

For Cultural Horizon I few comparisons can be drawn, since diagnostics or large numbers of artifacts were not found. The cultural occupation predates the later Besant-Woodland occupations and is dated to 2270 ± 80 B.P. or 320 B.C. The date falls within the Late Plains Archaic Period and may represent the Pelican Lake techno-complex, although this is speculation. A Pelican Lake occupation is known and dated from the Little Missouri Badlands at 32MZ38, Ice Box Canyon Ridge Site (Simon and Borchert 1981b). Radiocarbon dates from Feature B ranged from 2110 ± 90 to 1630 ± 80 B.P. and were corrected using dendrochronological data to A.D. 125, representing the end of the Pelican Lake materials. Future work at 32MZ333 should emphasize recovery of more materials associated with Cultural Horizon I to better understand the nature of this occupation.

Cultural Horizon III is dated within the Late Prehistoric Period at 318 ± 41 B.P. or A.D. 1632. Hampering comparison of these materials is the lack of diagnostic projectile points to compare with known Late Prehistoric assemblages. The Late Prehistoric Period is characterized by the greatest prehistoric expression of communal bison procurement (Frison 1978). These activities are represented at the Kobold site, Wardell site, Glenrock, Piney Creek site, Vore site, and

other classic bison kill sites (Frison 1978). Also, see Kehoe (1973) for a discussion of the Gull Lake site in southern Saskatchewan.

Late Prehistoric Period components are known in the Little Missouri Badlands, usually associated with multi-component non-stratified sites such as 32BI272 (Aivazian 1981), 32BI22 (Simon and Borchert 1981a), Cinnamon Creek Ridge Sites (East et al. 1981), 32MZ38 (Simon and Borchert 1981b). Little is known of these sites, and all are postulated to be short-term hunting camps or "transitory camps." Conspicuously lacking in the badlands region of North Dakota is a site representative of the classic Late Prehistoric bison drives and jumps described by Frison (1978) and Kehoe (1973). Again, known sites represent only a small aspect of the total cultural range present within the Late Prehistoric Period.

The investigations of Cultural Horizon III at 32MZ333 were limited and small in scale due to the confines of the USFS Scope of Work and the nature of the testing required to define the site parameters. Little is known of Cultural Horizon III and more needs to be done to define the exact nature of the site occupation. As previously stated, strong indications of association with a small bison kill episode are present at 32MZ333, representing the second such site yet investigated in the Little Missouri Badlands. The first, the Geary Site (32BI4), was partially excavated in 1980 and has recently been reported in final form (Loendorf et al. 1982). A discussion of the bone materials at 32MZ333 is contained in Borchert et al. (1982), and a discussion of the terrain is in Albanese (1982, Appendix 7.6). Although the relationship between these events can be speculated based upon geomorphic and soil information, it has not been verified by this testing phase.

5.2.5 Conclusions and Recommendations for Future Research

As a result of the testing at 32MZ333, it is recommended that the site be nominated for inclusion in the National Register of Historic Places. The site has definitely been proven to be of regional significance in the prehistory of western North Dakota and to the Northern Plains area as a whole.

The site has conclusive evidence of multiple/stratified cultural deposits, rare in the Little Missouri Badlands. Cultural Horizon I is dated at 2270 ± 80 B.P. and consists of Feature 9, located stratigraphically beneath the P5 paleosol. Cultural Horizon II is dated between 2041 ± 124 and 1890 ± 60 B.P. and consists of repeated Besant-Woodland occupations at the base of the P5 paleosol. These occupations represent the Late Plains Archaic-Late Prehistoric transition period. Cultural Horizon III within the P4 eolian sands above the P5 paleosol is dated to 318 ± 41 B.P. and is representative of the Late Prehistoric Period.

In addition, the presence of pottery within the badlands region is rare, and this may prove to be one of the oldest dated ceramic Woodland-Besant sites yet studied in the Northern Plains. The site has also extended the known southern range of Woodland ceramics in the area (Johnson, Appendix 7.3).

Also, the association of a bison kill episode with the cultural occupation in Horizon III is clearly possible. If these two events can be directly associated, this would be among the first evidences of Late Prehistoric bison kill sites and associated camps in the Little Missouri Badlands of western North Dakota.

Future work may be necessary at 32MZ333 prior to upgrading and construction of a permanent roadway through the site area. This testing should be confined to the direct impact corridor of the proposed road and should directly focus on the tested areas of Cultural Horizons I and II.

The testing should extend northward from the large block excavated at 34-37S 2-5W to the existing roadway. This will encompass the area of Feature 7 (28-29S 5-6W) as well as the L-shaped unit excavated in 1981 by UNDAR-West. Such testing is necessary to define further the nature of the cultural occupations of Horizon II and to examine the area for further traces of Horizon I.

The testing is necessary to attempt to recover additional diagnostics and tools representative of the Besant-Woodland techno-complex and to explore for further activity areas present in the construction zone. Little in the way of diagnostics or tool kits was recovered during the Phase I testing. An attempt should be made to recover further diagnostic elements from the pottery vessels, to radio-carbon date this element of the assemblage, and to link it

with other excavated activity areas at the site. This relationship remains unclear from the current project results.

Additional testing south between the excavated 4 x 4 (0N 3S 1E 2W) and the road is also recommended for the same reasons. This is the largest occupation area defined at the site, and the limits were not clearly defined by the initial test. Further information regarding this occupation of some duration may be destroyed by future road construction.

If the small point in the area of units 11-12N 56-61W is to be impacted, further testing of this small activity area is recommended. The area has been largely destroyed by erosion but contains potential for further information concerning the activities present and possible dating of the untyped projectile point recovered. A closer correlation between this activity area and the remaining areas of Cultural Horizon II is needed.

Further work on the upper Cultural Horizon III should not be necessary at this time. The areas defined are well out of the proposed impact area, and this portion of the site and the bison bone bed will not be disturbed. Testing of this area is recommended, however, prior to any future impacts.

All things to nothingness descend,
Grow old and die and meet their end;
Man dies, iron rusts, wood goes decayed,
Towers fall, walls crumble, roses fade....
Nor long shall any name resound
Beyond the grave, unless't be found
In some clerk's book; it is the pen
Gives immortality to men.

—Master Wace

(His rhymed, 12th Century
chronicles of the Norman Dukes)

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APPENDIX 7.1

Report of Radiocarbon Dating Analyses, Site 32MZ333

by

Jerry J. Stipp, Ph.D.
Murry A. Tamers, Ph.D.
Beta Analytic, Inc.

1982

Submitted to Powers Elevation

BETA ANALYTIC INC.

RADIOCARBON DATING, STABLE ISOTOPE RATIOS, THERMOLUMINESCENCE, X-RAY DIFFRACTION
P. O. BOX 248113 - CORAL GABLES, FLORIDA 33124 - (305) 667-5167

Mr. Robert A. Williams
Powers Elevation
600 South Cherry St., Suite 1201
Denver, Colorado 80222

July 26, 1982

Dear Mr. Williams;

Please find enclosed the results on the two charcoal samples you recently submitted for radiocarbon dating analyses on Rush Priority basis. We hope the dates will prove useful in your studies.

The samples were first picked for rootlets. They were then given an extensive hot acid pretreatment to eliminate any contamination by carbonates, rinsed to neutrality and then submitted to hot alkali solution to extract humic acids. This was followed by another acid treatment and final rinsing to neutrality. The benzene syntheses and subsequent radioactivity measurement proceeded normally.

We are enclosing our statement. Would you please forward it to the appropriate office for payment, standard net 30 days. If you have any questions and would like to confer with either of us regarding these or other dates, please don't hesitate to contact us at any time.

Sincerely yours,


Jerry J. Stipp, PhD
Co-director

JJS/hs
Encl:

**BETA ANALYTIC INC.**(305) 667-5167
(305) 667-5167UNIVERSITY BRANCH
P.O. BOX 248113
CORAL GABLES, FLA. 33124**REPORT OF RADIOCARBON DATING ANALYSES**FOR: Mr. Robert A. Williams
Powers Elevation
600 South Cherry Street, Suite 1201
Denver, Colorado 80222DATE RECEIVED: July 20, 1982
DATE REPORTED: July 26, 1982
BILLED TO SUBMITTER'S
INVOICE NUMBER letter of 7/20/82

OUR LAB NUMBER	YOUR SAMPLE NUMBER	C-14 AGE YEARS B.P. $\pm 1\sigma$	Material
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Beta-4999	32MZ333 - 1	1,890 \pm 65	Charcoal
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Beta-5000	32MZ333 - 2	215 \pm 60	Charcoal
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In agreement with international conventions, radiocarbon dates are calculated using the Libby half-life of 5568 years and 95% of the activity of the NBS Oxalic Acid as the modern standard. The quoted errors are one standard deviation based on the random nature of the radioactive disintegration process. B.P. stands for years before 1950 A.D. No corrections were made for isotopic fractionation in nature.

BETA ANALYTIC INC.

RADIOCARBON DATING, STABLE ISOTOPE RATIOS, THERMOLUMINESCENCE, X-RAY DIFFRACTION
P. O. BOX 248113 - CORAL GABLES, FLORIDA 33124 - (305) 667-5167

August 11, 1982

Mr. Robert A. Williams
Archaeology Division
Powers Elevation
600 South Cherry Street
Suite 1201
Denver CO 80222

Dear Mr. Williams:

Please find enclosed the results on three soil samples sent last week for radiocarbon dating analyses on the Rush Priority basis. We hope these dates will be useful in your research.

The soils were permeated with numerous rootlets. These were removed to the best of our ability by manually picking, as well as flotation and skimming. The soils were then dispersed in hot acid to remove carbonates, repeatedly rinsed to neutrality, brought to dryness and submitted to multiple combustions in an enclosed system. The following benzene syntheses and countings proceeded normally.

We are enclosing our statement. Would you pass this on to your accounting office for payment. If there are any questions, please call us at the above number.

Sincerely yours,

Murry Tamers

Murry Tamers, Ph.D.
Co-director

MT/hs
encs.

P.S. I'm also sending some more sample data sheets for future samples or to give to your friends that might need our service.



BETA ANALYTIC INC.

(305) 667-5167
(305) 667-5167

UNIVERSITY BRANCH

P.O. BOX 248113

CORAL GABLES, FLA. 33124

REPORT OF RADIOCARBON DATING ANALYSES

FOR: Robert A. Williams
Powers Elevation

DATE RECEIVED: August 5, 1982
DATE REPORTED: August 11, 1982

BILLED TO SUBMITTER'S
INVOICE NUMBER _____

OUR LAB NUMBER	YOUR SAMPLE NUMBER	C-14 AGE YEARS B.P. $\pm 1\sigma$
----------------	--------------------	-----------------------------------

Beta-5123	32 MZ 333-3	1400 \pm 50 B.P.
Beta-5124	32 MZ 333-4	2020 \pm 70 B.P.
Beta-5125	32 MZ 333-5	2270 \pm 80 B.P.

In agreement with international conventions, radiocarbon dates are calculated using the Libby half-life of 5568 years and 95% of the activity of the NBS Oxalic Acid as the modern standard. The quoted errors are one standard deviation based on the random nature of the radioactive disintegration process. B.P. stands for years before 1950 A.D.

APPENDIX 7.2

Report of Obsidian Hydration Dating Results

Site 32MZ333

by

Joseph W. Michels, Ph.D.

MOHLAB

1982

Submitted to Powers Elevation

MOHLAB

1188 Smithfield Street
State College, Pa. 16801
(814)237-8681

August 8, 1982

Invoice # 75

Robert Williams
Powers Elevation
600 South Cherry
Suite 1015
Denver, Colorado 80222

Dear Mr. Williams:

There was sufficient material to conduct compositional analysis on three of the four specimens submitted for dating from site 32 MZ 333. The results, derived by means of atomic absorption spectroscopy, are as follows (in % / wt. values):

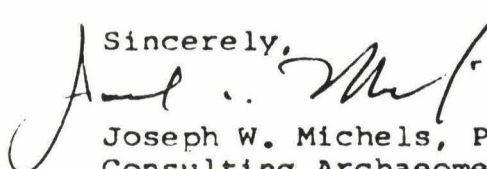
No.	SiO ₂	Al ₂ O ₃	Na ₂ O	K ₂ O	Fe ₂ O ₃ ^T	CaO	MgO	TiO ₂
#2	77.2	12.16	3.81	4.93	1.31	0.44	0.03	0.10
#3	77.1	12.20	3.81	4.94	1.31	0.49	0.03	0.10
#4	77.0	12.24	3.83	4.98	1.30	0.53	0.03	0.09

They indicate that all three (and probably all four) specimens derive from a common geological source. There is a close compositional matchup between these specimens and the Obsidian Cliff source (see MOHLAB TECHNICAL REPORT No. 2).

A site hydration rate of 2.66 u²/1000 yrs was applied to the hydration measurements, based upon temperature data supplied by Aivazian (11/27/81) and application of the Obsidian Cliff source rate. The resulting chronometric dates are as follows:

32-1	318 BP	+/- 41 yrs	(<u>assuming</u> Obsidian Cliff source origin)
32-2	1954 BP	+/- 87 yrs	
32-3	2041 BP	+/-124 yrs	
32-4	2006 BP	+/- 52 yrs	

All four obsidian flakes were consumed during the course of analysis.

Sincerely,

Joseph W. Michels, Ph.D.
Consulting Archaeometrist

APPENDIX 7.3

Ceramics from 32MZ333
McKenzie County, North Dakota

by

Ann M. Johnson, Ph.D.
Consulting Archaeologist

1982

Submitted to Powers Elevation

Ceramics from 32MZ333,
McKenzie County, North Dakota

Ann M. Johnson, Ph.D.

These sherds were recovered by Powers Elevation/Archaeology and by the University of North Dakota Archaeological Research-West (Borchert et al. 1982) from both surface and excavated locations. This material is described together because it represents a single ceramic tradition. The sherds were examined using both artificial and natural light. Weights were obtained with the use of a triple beam balance and magnification was provided by a binocular microscope. Munsell colors were measured on dry sherds. I wish to acknowledge the assistance of Stephen A. Chomko with the ceramic analysis.

Sample

Nine sherds representing a minimum of one vessel.

Paste

Clay: No analyses have been performed, and the clay body is assumed to be of local origin.

Temper: Plentiful crushed granite in the 1 to 3 mm diameter range. Individual chunks are as large as 5 mm in diameter.

Hardness: 3 to 4 (Mohs' scale).

Texture: The temper is evenly mixed with the clay body and the paste is compact. Five sherds have split parallel with the surfaces exposing the core. These sherds are also the smaller ones in the collection and may have been subjected to exceptional stresses while being reduced to their present sizes. The large sherds do not have laminations or cracks parallel to the surfaces. The paste is medium blocky, rather contorted, and coarse. Temper does not extend beyond the surface and usually not to it. Surfaces are smooth to touch.

Color: The exterior is light brownish grey (2.5Y6/2) and the interior is light grey (2.5Y7/2). The core gradually grades into both colors. Sherd No. 1982 (see Table) is very dark grey (7.5YR3/3) exterior and a dark grey (10YR4/1) interior.

Surface Finish: The interior is slightly irregular with pieces of temper at or sometimes slightly above the plane of the clay surface. There are oval shallow depressions that apparently represent finger impressions.

The exterior is smoothed over cord impressions. This smoothing sometimes completely obliterates the cord impressions. The cord is two ply and medium textured. The twist could be discerned on two sherds only and has a weak S_S twist. The two cords almost seem to have been plaited rather than twisted together. Individual strand has a 1 mm diameter. There are many overlapping cord impressions as are typically found on the lower vessel.

Method of Manufacture

The vessel was probably mass modeled. Shaping was done with a cord wrapped paddle, and incomplete smoothing of the cord impressions then occurred. It is not possible to determine if this was intentional or not as the thickness and curvature of these sherds suggest that they were from the lower vessel where handling would blur still-moist impressions.

Form

All are body sherds, probably from a relatively large vessel. Only straight and slightly curved pieces are in this collection.

Comparison

These sherds are assigned to the Plains Woodland tradition. They appear to represent the same component as the Besant projectile points. Sites with similar associations are Whiskey Hill (Johnson 1977), Indian Hill (Wood 1962), High Butte (Wood and Johnson 1973), and Sugarloaf Butte (Johnson, Treat, and Thompson n.d.). It is well known that many hilltops (ridgetops) in the Dakotas have Woodland (Besant) occupations such as Nightwalker's Butte (Lehmer, Wood and Dill 1978:217). Thus, site 32MZ333 is not unusual in its location or content.

In Plains Woodland, the shape of the rim and decoration are important criteria for distinguishing between different taxonomic units. Future investigations should try to obtain more pottery, especially those representing the upper portions of the vessel. The present collection offers little assistance for anything more than gross classification, and this will be insufficient data for future questions.

Comment

Woodland pottery had been found on the Missouri River (Wood 1962) and to the west in Montana (Johnson 1977), but not this far south of the Missouri River. It is logical that it would someday be found, but local collectors (Kent Anderson, personal communication) held that pottery was not found there. Site 32MZ333 thus extends the known range of Woodland pottery.

Sherd 1982 displays a polish on the exterior and interior surfaces. This extends over the rounded edges and is clearly post-depositional in nature. As the road has been graded and this artifact was a surface find, it is likely that this surface polish was caused by motorized vehicles of some nature running across the sherd.

Summary

Site 32MZ333 is identified as having a Plains Woodland (Besant) component on the basis of nine body sherds. Future work at the site should be designed to enlarge this limited ceramic sample and to obtain radiometric dates for the ceramic component.

Attributes for Ceramics

Specimen	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Comment
no number	25.9	22.1	9.6	5.8	surface, cord roughened
1982	23.1	19.8	9.7	4.60	surface, adjacent to UNLAR test units south of road
3A-1-1	19.7	19.3	7.9	2.65	surface, cord roughened
3A-1-2	11.1	9.8	4+	0.25	split
3A-1-3	16.2	12.1	6+	0.75	split, exterior surface apparently slightly eroded
3A-1-4	16.3	12.6	5+	0.90	split, smoothed over cord roughened
4A-1-1	12.2	10.5	5+	0.55	split, impressions smoothed over
4A-1-2	24.1	14.0	9.4	2.40	smoothed over cord roughening?
4A-1-3	18.4	15.2	7+	1.65	split

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APPENDIX 7.4

Faunal Remains from 32MZ333
McKenzie County, North Dakota

by

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1982

Submitted to Powers Elevation

Faunal Remains from 32MZ333,
McKenzie County, North Dakota

Stephen A. Chomko

ABSTRACT

The faunal remains from site 32MZ333 consist of 679 bone fragments of which 35 were identifiable to the species level. Two genera, Antilocapra and Bison, are present. The antelope is represented by 22 specimens, all elements of a single foot. A minimum of two bison, an adult (greater than 4 years old) and a juvenile (less than 1.5 years old), are represented in the sample of 13 identifiable bison fragments.

INTRODUCTION

The vertebrate faunal remains from site 32MZ333 were identified to the lowest specific taxonomic level possible by comparison to specimens in the Paleo-Environmental Consultants comparative osteological collection and through the use of standard reference manuals such as Gilbert (1980), Olsen (1964), and Olsen (1960). "Unidentifiable" bone fragments were identified as either "unidentifiable large mammal" (ULM) if the fragment could reasonably be expected to be from an animal larger than an antelope; "unidentifiable small mammal" (USM) fragments refer to specimens expected to be from animals smaller than antelope (based on thickness of the bone cortex). In the case of this faunal assemblage, other categories, such as unidentifiable rodent, were not necessary. All fragments were weighed to the nearest tenth of a gram using a triple beam balance. Notations were made as to whether the fragments were charred, pathological (no evidence observed in this sample), or exhibited evidence of butchering (one fragment) other than green bone breaks (see Bonnicksen, 1979, for a discussion of green bone breaks occurring through agencies other than human modification of bone).

The bone fragments were identified by analytical unit as received by Paleo-Environmental Consultants; identifications are recorded in the following tables by excavation area and subdivided by excavation unit, then by level. It is not known, at present, which levels were contemporaneous; thus, no attempt is made here to combine bone from different levels/analytical units. Consolidating the bone samples would have a marked effect on the computation of the minimum number of individuals (refer to Grayson 1973).

IDENTIFICATIONS

At least two genera are present in the faunal assemblage (Table 1 presents data on the identifiable bone). Antilocapra americana (pronghorn antelope) is represented by 22 bone fragments, all charred, and all from a single foot (side and limb determination is not possible). Ten long bone fragments probably represent the metapodial, and are tentatively assigned to this genus; one phalanx is represented by distal and proximal fragments. Thus, at least 12 antelope elements are present in the sample of 22 identifiable fragments. The epiphyses of the 2nd and 1st phalanges are fused indicating an individual at least 12 months old (by comparison with the age of closure for mule deer, Lewall and Cowan 1963).

Thirteen bone fragments, none charred, representing at least two individuals are identifiable as Bison bison. Three deciduous incisors exhibiting little wear indicate an individual between 6 and 18 months old (Frison and Reher 1970); the fused epiphysis of the distal humerus indicates an individual at least 48 months old (Duffield 1973). Seven bone fragments are probably all from a single horn core, and two molar fragments probably represent a single tooth; thus, there are at least six elements in the sample of 13 bison bone fragments.

Two tooth fragments are assignable to the generalized category of "unidentifiable artiodactyl." The fragments are too small to allow generic determination.

A total of 642 bone fragments are unidentifiable; 136 of these are charred (Table 2 presents data on the unidentifiable bone). The bone fragments were sorted into two categories (ULM and USM) based on cortical thickness. A total of 621 fragments (129 are charred) were assignable to the ULM group. In some cases it was apparent that the bones were broken following deposition in the site. In these cases, the number of fragments can be reduced to the number of elements (or portions thereof) originally present. For instance, the 31 bone fragments in Unit 35 South 5 West, Level 4, all probably represent a single element (that is, bone fragment) which was discarded at the site. When all such instances are taken into account, the "corrected" number of fragments of ULM in the assemblage is 370 (of which 94 are charred). Twenty-one bone fragments (seven of these are charred) are assignable to the USM category; evidence of post depositional breakage suggests a corrected number of elements would be 18 USM fragments. Since the category of "unidentifiable

small mammal" bone includes all species smaller than antelope, it is likely that this bone represents a third species at the site.

While most of the bone in the assemblage exhibits evidence of green bone breaks and spiral fractures, no evidence of butchering marks (cut marks) was observed. One bone fragment (ULM) is characteristic of a "bone flake" produced during the breaking of a long bone by hitting the diaphysis (see Bonnicksen 1979).

DISCUSSION

Table 3 presents summary data on the faunal remains from site 32MZ333; both the raw counts of bone fragments and "corrected" numbers of fragments are presented in addition to bone weights. Identifiable bone represents only 4.9% of the corrected number of fragments present. However, identifiable bone represents 66.2% of the bone assemblage by weight; a single bison humerus greatly biases this figure (by itself it represents 63.6% of the total bone weight). If the humerus is omitted from the computations, identifiable bone accounts for 6.6% of the bone mass and the average weight per bone fragment is 0.59 grams.

Suggested Research Questions

The distribution of the faunal remains should be evaluated to determine if:

- (1) there is a correlation of charred bone with features such as hearths or if the distribution suggests a discard (refuse) area,

- (2) the small size of the bone fragments is suggestive of bone grease/butter manufacture (see Vehik 1977),

- (3) the two bison represent a multiple kill or two separate episodes of hunting activity, and

- (4) there is a correlation (either positive or negative) of bone debris and cultural features/material.

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Table 1. Identifiable bone, 32MZ333

<u>Provenience</u>	<u>Fauna</u>	<u>Weight (grams)</u>	<u>Remarks</u>
35S 3W, Level 4	cf. <u>Bison bison</u> horn core 7 fragments	3.9	(probably one bone)
28-29S 5-6W, Feature 7, Level 3	<u>Antilocapra americana</u> 1st Phalanx Right Distal 2nd Phalanx Right Whole 3rd Phalanx Right Whole 1st Phalanx Left Distal 1st Phalanx Left Proximal 2nd Phalanx Left Proximal 2nd Phalanx Left Distal 3rd Phalanx 3 fragments Sesamoids (2) Long Bone Fragments (10)	1.3 3.2 1.9 2.1 0.6 1.0 0.4 0.6 0.5 1.5	charred charred charred charred charred charred charred charred charred charred
2S 2W, Level 1 (concentration/stain area)	<u>Bison bison</u> Incisor, (I-1) Right	0.4	deciduous
3S 2W, Level 1 (concentration/stain area)	<u>Bison bison</u> Incisor (I-2/3) Right Incisor (I-3) Right	0.1 0.2	deciduous deciduous
Unit Profile Cut 2 S½, Level 2, 14-20 cm BGS	Unidentifiable Artiodactyl tooth fragment	0.1	
Unit Profile Cut 2 N½, Level 2, 14-20 cm	Unidentifiable Artiodactyl tooth fragment	0.3	
Unit Profile Cut 2 N½, Level 5, 36 cm BGS	cf. <u>Bison</u> , 2 molar fragments	1.9	
47S 11E, Level 4, 25-35 cm	<u>Bison bison</u> Humerus Left Distal	423.6	

Table 2. Unidentifiable bone from 32MZ333

<u>Provenience</u>	<u>Fauna</u>	<u>Weight (grams)</u>	<u>Remarks</u>
<u>"4 x 4 South of Road, F-8 & Misc. Level 4"</u>			
35S 5W, Level 4	ULM 31 fragments	2.2	probably one bone
35S 3W, Level 4	ULM 1 fragment	0.1	charred
Feature 8	ULM 19 fragments	6.9	charred
	USM 5 fragments	0.4	charred
<u>"28-29S 5-6W, Feature 7"</u>			
28S 6W, Level 3 (vicinity Feature 7)	ULM 17 fragments	11.7	
<u>"4 x 4 North of Road, 0N 3S, 1E 3W"</u>			
3S 1E, Level 1	ULM 1 fragment	1.0	charred
	USM 1 fragment	0.2	charred
1S 1E, Level 1	ULM 2 fragments	0.6	charred
	ULM 5 fragments	0.7	probably one bone
1S 1W, Level 1	ULM 2 fragments	0.4	
	ULM 1 fragment	*	charred
	USM 1 fragment		
1S 0W, Level 1	ULM 36 fragments	2.0	probably one bone
2S 2W, Level 1 (concentration/stain area)	ULM 7 fragments	1.6	two possibly charred

Table 2. Unidentifiable bone from 32MZ333 (cont.)

<u>Provenience</u>	<u>Fauna</u>	<u>Weight (grams)</u>	<u>Remarks</u>
2S 1W, Level 1 (vicinity Feature 1)	ULM 5 fragments	0.7	
	ULM 21 fragments	5.1	charred
	USM 1 fragments	*	charred bone sample
	ULM 32 fragments	2.2	probably two bones
2S 0W, Level 1	ULM 6 fragments	0.9	
Feature 1	ULM 6 fragments	0.6	charred
	ULM 14 fragments	2.4	
	ULM 2 fragments	0.2	charred
3S 1W, Level 1	ULM 14 fragments	1.3	
	ULM 2 fragments	1.5	charred
3S 1W, Level 1	ULM 14 fragments	1.3	
	ULM 18 fragments	1.5	charred
	ULM 3 fragments	6.1	"mapped in"
	USM 1 fragment	*	
3S 2W, Level 1 (concentration/stain area)	ULM 16 fragments	2.6	probably one bone
	ULM 4 fragments	0.4	
0N 1E, Level 1	ULM 4 fragments	8.0	
	ULM 2 fragments	0.6	charred
0N 1W, Level 1	ULM 1 fragment	1.1	bone flake
<u>"11N 61W, 11N 59W (on point)"</u>			
11N 61W, Level 2, 10-20 cm BGS	ULM 1 fragment	3.8	
11N 59W, Level 3, 20-30 cm BGS	ULM 18 fragments	12.5	probably one bone

Table 2. Unidentifiable bone from 32MZ333 (cont.)

<u>Provenience</u>	<u>Fauna</u>	<u>Weight (grams)</u>	<u>Remarks</u>
<u>"Profile Cut No. 1 and 52-53 South, 27.8 West"</u>			
Unit Profile Cut 1			
Level 2, 7-13 cm BGS	ULM 41 fragments	15.9	
	ULM 10 fragments	3.6	charred
	USM 2 fragments	*	
	USM 1 fragment	*	charred
Unit Profile Cut 1, S $\frac{1}{2}$, Level 4, 26 cm BGS	USM 8 fragments	18.4	probably 2 or 3 bones
Unit Profile Cut 1, N $\frac{1}{2}$, Level 4, 30-45 cm BGS	ULM 1 fragments	0.2	
	USM 1 fragments	*	
Unit Profile Cut 1, 52S 27.8W, Level 2	ULM 13 fragments	2.2	probably one bone
Unit Profile Cut 1, 53S 27.8W, Level 2	ULM 36 fragments	7.4	
	ULM 7 fragments	1.6	charred
<u>"Profile Cut No. 2"</u>			
Unit Profile Cut 2 S $\frac{1}{2}$, Level 2, 14-20 cm BGS	ULM 70+ fragments	24.4	
Unit Profile Cut 2, N $\frac{1}{2}$, Level 1, 0-14 cm BGS	ULM 36 fragments	18.5	probably one or two bones
Unit Profile Cut 2, N $\frac{1}{2}$, Level 2, 14-20 cm BGS	ULM 50+ fragments	13.8	probably one or two bones

Table 2. Unidentifiable bones from 32MZ333 (cont.)

<u>Provenience</u>	<u>Fauna</u>	<u>Weight (grams)</u>	<u>Remarks</u>
<u>"Level 5, Feature 9"</u>			
Feature 9 (35S 4W)	ULM 12 fragments	3.3	
35S 5W, Level 5 (bone on pedestal, F-9)	ULM 34 fragments ULM 5 fragments	20.5 9.9	probably one bone
<u>"Level 5, Feature 9"</u>			
36S 5W, Level 5 F-9	ULM 17 fragments	8.2	probably one bone

Notes

ULM = Unidentifiable large mammal

USM = Unidentifiable small mammal

* = less than 0.1 gram

Table 3. Summary data on the faunal remains from 32MZ333

	Count	Corrected Count	Weight (grams)	Percent by Corrected Count	Percent by Weight
Antelope	22	12	13.1	2.9	2.0
Bison	13	6	426.6	1.5	64.1
Artiodactyl	2	2	0.4	0.5	0.1
ULM	621	370	206.7	90.7	31.0
USM	21	18	19.0	4.4	2.9
Totals	679	408	665.8	100.0	100.1

APPENDIX 7.5

Pollen and Macrofloral Analysis
at Sites 32MZ333 and 32MZ334
McKenzie County, North Dakota

by

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1982

Submitted to Powers Elevation

Pollen and Macrofloral Analysis
at Sites 32MZ333 and 32MZ334
McKenzie County, North Dakota

Linda J. Scott

INTRODUCTION

Two prehistoric campsites, 32MZ333 and 32MZ334, in the Little Missouri Badlands of western North Dakota were sampled for pollen and macrofloral analysis. These sites are located on ridges above the Little Missouri River. Stratigraphic profiles from both sites were sampled for pollen to provide paleoenvironmental data for the periods that the sites were occupied. Flotation samples were taken from the fill of seven features at 32MZ333 to provide subsistence data. These features range in date from ca. 215 B.P. to 2270 B.P.

METHODS

Pollen was extracted from soil samples submitted from Powers Elevation/Archaeology. A chemical preparation based on flotation was selected for removal of the pollen from the large volume of sandy loam with which they were mixed.

Hydrochloric acid (10%) was used to remove calcium carbonates present in the soil, after which the samples were screened through 150 micron mesh. Lycopodium tablets (containing spores not native to this area) were added to the weighed samples to facilitate the calculation of absolute pollen frequencies. Zinc bromide (density 2.0) was used for the flotation process. All samples received a short (5 minute) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples were then acetolated for three minutes to remove any extraneous organic matter. After rinsing, the samples were mounted on microscope slides for analysis.

The pollen was identified using a light microscope to count the pollen to a total of 200 grains per sample at a magnification of 430X. Pollen preservation in these samples varied from poor to good. Comparative reference material collected at the Intermountain Herbarium at Utah State University and the herbarium at the University of Colorado was used to identify the pollen to the family, genus, and species level, where possible.

Calculation of the absolute pollen frequencies was based on the total Lycopodium spores observed while counting 200 pollen grains. Absolute pollen frequencies reflect the amount of pollen deposited per gram of soil. The rate of soil aggradation, as well as environmental factors affecting the growth and reproduction of plants, contribute to the final quantity of pollen deposited in the soil.

Flotation samples were taken from hearth fills. All samples were floated at Palynological Analysts using a modification of the flotation procedures outlined by Matthews (1974). The dried samples were measured and passed through a series of graduated screens (U.S. Standard Sieves with 4 mm, 2 mm, 1 mm, and 0.5 mm openings) to separate charcoal debris and to initially sort the seeds. The contents of each screen were then examined, separating the macrofloral remains.

The seeds were identified to family and usually genus level by Deborah T. Seward using a reference collection from the Barrett Herbarium at the University of Utah, the Seed Identification Manual (Martin and Barkeley 1961), and "A Guide to the Identification of Seeds Used by Prehistoric Indians" (Albee 1980).

Because the number and/or amount of macrofloral fragments and seeds reflects nothing more than preservation for that particular sample, all tabulations are based simply on the presence or absence of each taxa. For instance, within any sample each taxa identified was counted as a single occurrence, whether represented by one or many seeds. This insures that accidents of preservation are not mistaken for changes in cultural utilization (Barnett and Coulam 1980). It also prevents misinterpretation of resource utilization based on differential seed production of various plants.

PRESENT ENVIRONMENT

The project area is located in the McKenzie Ranger District of the Custer National Forest in western North Dakota. Site 32MZ333 is situated along the top of a ridge at an elevation of 2480 feet. The predominant vegetation at the site is short and medium prairie grasses with prickly pear cactus and sagebrush. The soil consists of an eolian deposition overlying a Tertiary sandstone. Water drainages close to the site are primarily ephemeral springs and creeks which exhibit a heavy vegetational cover, including juniper (Juniperus), cottonwood (Populus),

boxelder (Acer negundo), and buffaloberry (Shepherdia). Wooded draws near the site support boxelder, cottonwood, aspen (Populus), hawthorne (Crataegus), buffaloberry, and a small amount of buckbrush (Symphoricarpos). The vegetational ecotone between the shortgrass prairie and sage near the site and that of the wooded draws is characterized by buckbrush, hawthorne, sagebrush (Artemisia), prickly pear (Opuntia), and juniper (Borchert et al. 1982).

Site 32MZ334 is located on a ridgetop at an elevation of approximately 2300 feet. The vegetation at this site is mainly shortgrass prairie with sagebrush. The soil is similar to that at 32MZ333. Several intermittent creeks are noted to flow near the site. The vegetation in the hardwood draws surrounding the nearby creeks is similar to that in the draws near 32MZ333, including cottonwood, boxelder, buffaloberry, and buckbrush. In addition, a number of unidentified, low-growing shrub and grass species were noted (Borchert et al. 1982).

DISCUSSION

Paleoenvironment

Reconstruction of past environments at these sites is based on pollen data from stratigraphic profiles from Sites 32MZ333 and 32MZ334. The samples from 32MZ333 were taken in arbitrary levels at 10 cm intervals, while those at 32MZ334 were taken in natural levels where the depths vary (Table 1). Radiocarbon dates from features within several of the levels at 32MZ333 are used to assign dates to the pollen sequence at that site. Both a radiocarbon date (215 ± 60 B.P.) and an obsidian date (318 ± 41 B.P.) were reported for Feature 4 in Level 2. Comments from the radiocarbon lab concerning possible contamination of the sample by modern rootlets, which may have resulted in the sample being too young by up to 100 years, has led to the preference of the 318 B.P. date for this feature and level (Williams, personal communication, August 16, 1982). Level 3 is dated by radiocarbon dates from Feature 8 (1890 ± 65 B.P.) and Feature 7 (2020 ± 70 B.P.), and an obsidian date from Feature 7 (1954 ± 87 B.P.). These dates cluster to produce a date range of approximately 1890 to 2020 B.P. for Level 3. Levels 2 and 3 were the primary cultural levels, with Level 3 yielding the most features. Level 4 was a sterile level separating levels 3 and 5. Level 5 contained cultural material but not in the abundance

Table 1

Provenience of Pollen and Flotation Samples
from 32MZ333 and 32MZ334

<u>Sample No.</u>	<u>Feature</u>	<u>Depth in cm below pgs</u>	<u>Radiocarbon/ Obsidian Date</u>	<u>Description</u>
32MZ333 Pollen (Profile Cut 2):				
10		0-10		Level 1, mixture of present ground surface and soil to a depth of 10 cm
20		10-20	215 ± 60 B.P. 318 ± 41 B.P.	Level 2, culture bearing level
30		20-30	1890 ± 65 B.P. 1954 ± 87 B.P. 2020 ± 70 B.P.	Level 3, culture bearing level, heaviest concentration
40		30-40		Level 4, sterile separation layer
50		40-50	2270 ± 80 B.P.	Level 5, culture bearing level, pollen not counted
60		50-60		Level 6, sterile layer underlying site
32MZ333 Flotation:				
1	1		1400 ± 50 B.P. 2006 ± 52 B.P. 2041 ± 124 B.P.	Level 1, shallow basin hearth fill
3	3			Level 1, rock-lined roasting pit fill at base of paleosol near Feature 1
4	4		215 ± 60 B.P. 318 ± 41 B.P.	Level 2, Profile Cut 1
5	5			Level 3, shallow basin hearth fill
7	7		1954 ± 87 B.P. 2020 ± 70 B.P.	Level 3, shallow basin hearth fill
8	8		1890 ± 65 B.P.	Level 3, deep basin hearth fill
9	9		2270 ± 80 B.P.	Level 5, large diffuse stain

Table 1 (continued)

<u>Sample No.</u>	<u>Feature</u>	<u>Depth in cm below pgs</u>	<u>Radiocarbon/ Obsidian Date</u>	<u>Description</u>
32MZ334	Pollen:			
1		0-13		Level 1
2		13-19		Level 2
3		20-23		Level 3
4		23-42		Level 4

observed in Level 3. A radiocarbon date of 2270 ± 80 B.P. was obtained from Feature 9 in this level. Level 6 was devoid of archaeological remains but was sampled for pollen since it represented the sterile level underlying the site.

The pollen record from 32MZ333 exhibits a wide variety of pollen taxa representing the grassland/sagebrush environment near the site, as well as the wooded draws, and the shrub and juniper interface between the grassland and draws. The pollen diagram of relative pollen frequencies (Figure 1) exhibits the relative quantities of all pollen taxa observed at the site. Although the present ground surface was not sampled specifically, the uppermost pollen sample from 0-10 cm contains soil from the present ground surface down to a depth of 10 cm. This sample displays evidence of local vegetation, including sagebrush (*Artemisia*), Chenopods, grasses (Graminae), sedges (Cyperaceae) (Table 2), and other low-growing herbs. *Juniperus* pollen which occurs in the sample is probably being transported from the ecotone between the grassland area surrounding the site and the hardwood environment of the draws, while *Pinus* pollen must have been transported from farther away. Pollen from the hardwood draws and riparian community includes boxelder (*Acer negundo*), birch (*Betula*), ash (*Fraxinus*), cottonwood (*Populus*), oak (*Quercus*), and willow (*Salix*).

Throughout the pollen record from this site, which appears to represent over 2300 years, the major vegetal elements of the environment appear to remain the same. The grasslands/sage area appears to have been present in the vicinity of the site during this entire time, although its composition may have varied through time. A comparison of the absolute pollen diagram of selected taxa (Figure 2) with that of the more traditional relative frequency diagram (Figure 1) displays many similar trends. The primary difference is the very small quantity of pollen recorded in the sterile Level 6 from 50-60 cm. This may be a result of rapid soil aggradation at this point, thus diluting the pollen record. This author has also frequently noted that sterile levels often contain significantly less pollen than do levels containing culturally derived deposits. This certainly holds true for this lowest sterile level but does not apply to the sterile separator level (Level 4) above.

Level 6, the lowest level, exhibits a pollen record indicating that the floral communities must have been much

Table 2

Pollen and Seed Taxa Observed
at 32MZ333 and 32MZ334

<u>Scientific Name</u>	<u>Common Name</u>
<u>Abies</u>	Fir
<u>Acer negundo</u>	Boxelder
<u>Alnus</u>	Alder
<u>Betula</u>	Birch
<u>Fraxinus</u>	Ash
<u>Juniperus</u>	Juniper
<u>Picea</u>	Spruce
<u>Pinus</u>	Pine
<u>Populus</u>	Cottonwood
<u>Quercus</u>	Oak
<u>Salix</u>	Willow
<u>Ulmus</u>	Elm
<u>Caryophyllaceae</u>	Pink Family
<u>Celastrus</u>	Climbing bittersweet
<u>Cheno-ams</u>	Members of the Chenopodiaceae (goosefoot family) and <u>Amaranthus</u> (pigweed)
<u>Atriplex</u>	Saltbush
<u>Sarcobatus</u>	Greasewood
<u>Compositae</u>	Sunflower family
<u>Artemisia</u>	Sagebrush
<u>Low-spine</u>	Includes <u>Ambrosia</u> (ragweed), <u>Franseria</u> (bur-sage), and <u>Xanthium</u> (cocklebur)
<u>High-spine</u>	Includes <u>Chrysothamnus</u> (rabbitbush), <u>Aster</u> (aster), <u>Helianthus</u> (sunflower) and others
<u>Gutierrezia</u>	Snakeweed
<u>Liguliflorae</u>	Includes <u>Taraxacum</u> (dandelion) and <u>Chichorium</u> (chickory)
<u>Cruciferae</u>	Mustard family
<u>Cyperaceae</u>	Sedge family
<u>Ephedra</u>	Mormon tea
<u>Galium</u>	Bedstraw
<u>Graminae</u>	Grass family
<u>Sporobolus</u>	Drob seed
<u>Heuchera</u>	Alum root
<u>Labitae</u>	Mint family
<u>Liliaceae</u>	Lily family
<u>Linum</u>	Flax
<u>Malva neglecta</u>	Cheeseweed
<u>Mitella</u>	Miterwort
<u>Opuntia</u>	Prickly pear cactus
<u>Oxalis</u>	Sorrel

Table 2 (continued)

<u>Scientific Name</u>	<u>Common Name</u>
<u>Plantago</u>	Plantain
<u>Phlox</u>	Phlox
<u>Eriogonum</u>	Buckwheat
<u>Polygonum aviculare-type</u>	Knotweed
<u>Rumex</u>	Dock
<u>Ranunculaceae</u>	Buttercup family
<u>Rosaceae</u>	Rose family
<u>Crataegus</u>	Hawthorne
<u>Potentilla</u>	Prairie cinquefoil
<u>Shepherdia</u>	Buffaloberry
<u>Solanaceae</u>	Potato or tomato family
<u>Physalis</u>	Groundcherry
<u>Solanum</u>	Nightshade or buffalo bur
<u>Symphoricarpus</u>	Buckbrush
<u>Umbelliferae</u>	Parsley or carrot family
<u>Selaginella densa</u>	Rock selaginella, Little club moss

much as they are today. Many of the major pollen taxa are represented in similar relative frequencies as are noted in the uppermost sample. The lack of diversity in the pollen taxa observed is probably the result of deterioration of the pollen grains through time in the soil. Unfortunately, Level 5, sampled from 40-50 cm, exhibited an extreme amount of deterioration in the pollen, which was deemed too severe to permit positive identification of even 50% of the pollen grains present. Therefore, no analysis of this level was attempted. Level 4, another sterile level, is similar to Level 6, with the exception that there has been a slight decline in the Artemisia (sagebrush) frequency and a rise in the Graminae (grass) frequency. This level also exhibited a high quantity of distorted and deteriorated pollen grains, which are reflected in the "poorly preserved" category on the pollen diagrams.

Level 3, which dates to approximately 1890-2020 B.P., represents the first cultural level to contain pollen for analysis. This level exhibits an increase in Chenopod pollen, which may be in response to either environmental conditions or to the increased disturbance of the ground by the occupants of the site. This increase is displayed in both the relative and absolute pollen diagrams. There is also a slight increase in low-spine Compositae, which also respond to increased disturbance of an area. This increase is noted primarily in the absolute pollen frequency. There is an increase in the variety of pollen taxa observed in Level 3, possibly also representing plants which have responded favorably to the disturbance of the landscape by the occupants of the site. Populus, which grows in the hardwood draws, is the only plant to show a drop in both relative and absolute frequency in this level, possibly indicating that it was being utilized by the occupants of the site or responding to environmental pressures, such as increased irregularity in the flow of the ephemeral streams, downcutting of the streambed, and/or lowered water table. Juniperus pollen representing the ecotone between the grassy area of the site and the hardwoods of the draws remains stable in this level compared to the lower levels.

Level 2, also a cultural level which dates between 215 and 318 B.P., displays a slight increase in the relative Artemisia frequency. Cyperaceae remains stable in both the relative and absolute frequencies, while Graminae decreases in both frequencies. The decrease in Graminae

frequency in this level may, again, be in response to either an environmental factor, such as a decrease in summer precipitation, or to increased utilization of the area. This level also displays a wide variety of pollen taxa, but not necessarily the same taxa that were observed in Level 3. These plants may have increased in numbers or been introduced to the site area through disturbance, which accompanies site occupation. The Populus pollen increases to its former quantity exhibited in Level 4 in both the relative and absolute pollen frequencies of this level. Other elements of the hardwood draw environment also persist in this level, suggesting that this econiche was present. Juniperus pollen remains stable in the relative diagram but increases slightly in the absolute pollen record, indicating that the interface ecotone between the grassland and hardwood draws remained relatively stable.

The uppermost level (Level 1) displays increases in several pollen taxa relative to the lower levels. Juniperus pollen increases in both relative and absolute frequencies, as does the Cyperaceae pollen. Populus declines slightly, suggesting that it is no longer quite as abundant as it once was. The Chenopods decline also to their relative frequencies exhibited in the sterile levels (4 and 6). The Artemisia frequency appears to decline slightly in the relative diagram but is noted to increase as an absolute pollen frequency. In both diagrams, however, it is the major component of the pollen record, indicating its importance to the environment. Graminae pollen increases slightly in both relative and absolute pollen frequencies to almost the same quantity displayed in Level 3. Pinus pollen, which is the result of long distance transport, increases slightly throughout the pollen diagram at this site and may reflect an increase in the regional pine populations.

Selaginella densa (rock selaginella or little club moss) is represented at this site in small quantities in the pollen record. The variation in frequency is probably related to the presence of rocks supporting Selaginella densa on or near the spot sampled.

Site 32MZ334 is represented by four samples taken from natural levels in an excavation unit (Table 1). The various levels do not necessarily correspond with those of 32MZ333. No radiocarbon or obsidian dates are available from this site because no charcoal-bearing features or obsidian were encountered. The pollen record from this site is

different from that at the previous site. The uppermost sample, containing soil from the present ground surface to a depth of approximately 13 cm below the surface, is very similar to that of 32MZ333. The area around this site does, however, appear to be richer in small herbaceous plants.

Level 4 represents an archaeologically sterile level and, like the lowest sterile level at 32MZ333, it contains less pollen per gram of soil than do the upper samples. This level is similar to the uppermost sample from 32MZ334 in relative frequency of Cheno-ams and Artemisia. Low-spine and Graminae pollen relative frequencies are higher in the sterile level than in the uppermost level, while Cyperaceae is lower. Elements of the hardwood draws are only rarely represented in both Levels 4 and 1. The ecotone separating the grassland/sagebrush area at the site along the top of the ridge and the hardwood draw appears to have been reduced in size prior to occupation of the site. Juniperus pollen is represented in both the relative and absolute pollen records by very small quantities of pollen. It should be noted that the pollen in this level was severely deteriorated, making the identification of numerous pollen grains impossible. It was included in this study only to serve as a superficial comparison with the lowest sterile level at 32MZ333 and as a basis for comparison for the rest of the stratigraphic column from 32MZ334. It is probable that several of the pollen taxa are under-represented in the pollen diagram, due to the deterioration of the pollen.

Level 3, a cultural level, witnesses a rise in the local Artemisia pollen, in both the relative and absolute pollen frequencies. The Graminae and Cyperaceae frequencies appear to remain stable in the relative pollen diagram but are observed to increase in the absolute pollen record. The local vegetation appears to be comprised of more sagebrush and smaller quantities of Cheno-ams, grasses, and sedge. The hardwood draws, however, appear to increase their contribution to the pollen record. Populus pollen increases significantly and Acer negundo and Quercus both appear in the pollen record, as do Betula and Ulmus. The Juniperus pollen frequency increases only slightly in this level, indicating little change in the interface ecotone between the grasslands/sagebrush and hardwood draws.

Level 2, also a cultural level, exhibits a continued rise in Artemisia frequency, both in the relative and absolute

frequencies. The absolute pollen diagram demonstrates that this increase is not at the expense of other elements of the grassland/sagebrush environment in the vicinity of the site but probably reflects an increase in the density of vegetation, especially sagebrush. Cheno-ams also exhibit an increase in absolute pollen frequency, although they display a smaller increase in the relative frequency. These plants may be increasing in response to disturbance of the area by the occupants of the site. The Populus and other taxa of the hardwood draws decline in this sample, possibly in response to erratic moisture, downcutting of the streambed, lowered water table, or to utilization of these resources by the occupants of the site. The Juniperus frequency remains relatively stable, increasing only in the absolute pollen record, indicating that the interface ecotone between the grasslands/sagebrush and hardwood draws near this site remained relatively stable. The large increase in Pinus pollen observed in Level 2 may represent the increase in regional pine populations.

The uppermost sample at 32MZ334 exhibits a decrease in Artemisia (sagebrush) pollen, but relative stability in Cheno-am and low-spine Compositae frequencies. Cyperaceae increases slightly in this level and Graminae declines. Populus and the other elements of the hardwood draws return to the levels evident in the relative frequencies in the sterile level (4). In absolute quantities, however, Populus appears to have increased. Juniperus pollen increases slightly in this level, indicating that the interface ecotone is probably at its widest at the present time.

Selaginella densa is observed in greater abundance in the upper three levels at this site than are pollen grains. Selaginella densa is a cryptogram that grows on rocks and produces spores which are not widely dispersed in the atmosphere. The very high frequencies of Selaginella densa spores are probably a result of the presence of rock selaginella on most or all of the rocks at this site, from which they contribute spores in abundance to the soil.

Subsistence

All of the features sampled for flotation are from 32MZ333 (Table 3). The radiocarbon dated hearths fall into the Late Plains Archaic and Late Prehistoric periods (3500-1250 B.P. and 1050-200 B.P., respectively). Very little in the way of macrofloral remains was obtained from the

Table 3
Macrofossil Remains from 32MZ333

Sample No.	Radiocarbon Dates in years B.P.	Cheno-ams	Artiplex	Graminae	Sporobolus	Malva neglecta	Rumex	Grass fragments	Twigs	Insect Segments	Snail Shells	Catkins	Bud tips
4	215-318	u	u	u	u	u	u	u/b	u/p	u	u		u
1	1400-2041			u				u/b	u			u	u
3								u/b		u			
5								u/b					
8	1890							u/b	b				
7	1954-2020							u/b					
9	2270	u/p						u/b					

Key:

u = unburned
p = partially burned
b = burned

fill of seven hearths sampled for macrofloral remains. All of the seeds recovered were unburned, with the exception of some Cheno-am seeds from Feature 9, which appeared to have been partially burned, or at least discolored. The features which fall within the Late Plains Archaic Period exhibit little or no seed remains, although burned and unburned grass fragments are common to all of the hearths analyzed. Feature 9, a large diffuse stain from Level 5, is the oldest "hearth," with a radiocarbon date of 2270 ± 80 B.P. This hearth contained both unburned and partially burned Cheno-am seeds.

Feature 1, a shallow basin hearth, has been radiocarbon dated to 1400 ± 50 B.P., but the date was thought to have been contaminated, probably through rodent activity. Obsidian dates obtained from artifacts within this hearth date to 2006 ± 52 and 2041 ± 24 B.P. These dates are accepted as more representative of the actual date of the hearth (Williams, personal communication, August 16, 1982). This hearth contained unburned Graminae (grass) seeds, as well as unburned twigs, unburned catkins, unburned bud tips, and the ubiquitous burned and unburned grass fragments. Features 1 and 3 were both noted within Level 1 but were from a portion of the site removed from the pollen profile. This area of Level 1 contained no modern soil and exhibited erosion of the paleosol. Feature 3 is a rock-lined roasting pit located at the base of the paleosol near Feature 1. The fill from this feature contained no seeds, some unburned insect segments, and the ever-present burned and unburned grass fragments.

Feature 8, a deep basin-shaped hearth full of charcoal, is located at the base of Level 3. The radiocarbon date obtained from this hearth is 1890 ± 65 B.P. This hearth fill contained no seeds, some burned twigs, and burned and unburned grass fragments.

Feature 7, a shallow basin-shaped hearth, is also from the base of Level 3. The radiocarbon date from this hearth is 2020 ± 70 B.P., while the obsidian date is 1954 ± 87 B.P. Only burned and unburned grass fragments were noted from this hearth fill.

Feature 5, a shallow basin-shaped hearth, is also located at the base of Level 3. No radiocarbon date was obtained from this feature but it probably dates to a similar time period as Features 7 and 8, which are from the same level. Again, no seeds were noted in this sample, only burned and unburned grass fragments.

Feature 4 is the only hearth sample from the Late Prehistoric Period. The radiocarbon date for this hearth is 215 ± 60 B.P. but it may be approximately 100 years too young due to rootlet contamination (Williams, personal communication, August 16, 1982). The obsidian date from this hearth is 318 ± 41 B.P. This hearth is the only one from this study to contain a variety of seeds. Unburned seeds of Atriplex, Chenopodium, Graminae, Sporobolus, Malva neglecta, and Rumex were noted in this sample. In addition, unburned insect segments, snail shells, and bud tips were observed, as well as both unburned and burned twigs and grass fragments.

The study of a series of hearth fills from the Powder River Basin in Wyoming suggested that hearths from the Late Prehistoric Period may exhibit significantly more variety in seed taxa present than hearths from the Late Plains Archaic Period (Scott and Seward 1982). The hearths from 32MZ333 may be divided into Late Plains Archaic (Features 1, 3, 5, 7, 8, and 9) and Late Prehistoric (Feature 4) periods. Even though the seeds from these hearths are not carbonized, the hearth from the Late Prehistoric Period contains many times the variety of seed taxa than do any of the hearths from the Late Plains Archaic. Features 1 and 3 (dating to the Late Plains Archaic) from the eroded paleosol of Level 1 were noted within the zone of root penetration, as was Feature 4 from the Late Prehistoric Period. Features 1 and 3 contained very few seeds, while Feature 4 contained a large variety of seeds.

Although all of the seeds noted in the flotation samples are edible and have been utilized as food by various Indian groups, the fact that none of the seeds recovered from the hearth fills at this site are burned raises the question of the origin of these seeds. Are they representative of cultural activity and use of these features, or are they the result of contamination from a natural source, such as rodent activity or downward movement of seeds along roots? Generally, carbonized seeds are taken to indicate association with utilization of hearths, while unburned seeds are held to be of questionable origin (from the utilization of the feature or a source of contamination). The consistent presence of unburned and burned grass in these hearths points to the possibility that these hearths were used to bake roots rather than to parch seeds. Hoebel (1960) notes that the Cheyenne bake roots by putting a layer of wet grass over heated rock and hot ashes prior to putting

in the roots. The roots are then covered with more grass and then dirt, on top of which a fire is built and allowed to burn until the roots are thoroughly baked. The unburned seeds in these samples may have been introduced into the hearth with the grass layers used to line the pit or to cover the roots to be cooked.

SUMMARY AND CONCLUSIONS

Pollen analysis of stratigraphic profiles from two sites, 32MZ333 and 32MZ334, in the Little Missouri Badlands in western North Dakota provides a sequence for the past 2300+ years. The present vegetation in the vicinity of these sites, as well as the hardwood draws and the interface ecotone between these two environments, is a relatively good model for the paleoenvironment. There have been shifts in the relative composition of each of these environmental zones but it appears that they were all present in this area throughout the occupation of these sites. Sagebrush appears to have been more locally abundant at 32MZ334 than it was at 32MZ333. Conversely, the sedges and grasses appear to have been more abundant at 32MZ333. The Cheno-ams increase in abundance during the occupation of 32MZ333, possibly in response to disturbance of the area by the occupants of the site. The greatest variety of pollen taxa is noted in Levels 2 and 3 at 32MZ333 and in Levels 1 and 2 at 32MZ334. At 32MZ333, the hardwood draw environment appears to be well established prior to occupation of the area, whereas the poor preservation of the sterile level at the bottom of the deposits at 32MZ334 makes it difficult to assess this component of the environment. While the interface ecotone between the grasslands/sagebrush areas on top of the ridges and hardwood vegetation of the draws appears to be well established in the lowest levels of 32MZ333, it is established later at 32MZ334.

Albanese (Appendix 7.6) notes that the ground surface during the period of occupation of 32MZ333 was more undulating than at present. He postulates that the dissection of the landscape evident today occurred after the Besant period occupation of the area (post 1600 B.P.). Down cutting of the stream channels to form the present arroyos would have the effect of removing the hardwood population farther from the site, making pollen deposition from this element of the environment more sporadic at the site. The pollen from trees that may be associated with the stream channel fluctuates throughout the pollen record at 32MZ333, but exhibits a downward trend. At 32MZ334, this pollen decreases significantly in Level 2 compared to Level 3. These trends

largely reflect the fluctuations in Populus pollen throughout the pollen record, although Acer negundo, a tree usually found along stream banks, also exhibits a reduction in frequency from the lower to upper levels. While these trends are suggestive of a slight change in the wooded draws relative to the archaeological sites, they are not definitive of the type of change or time at which it occurred.

The pollen record at 32MZ333 jumps from approximately 1890-2020 B.P. in Level 3, an occupational level, to 215-318 B.P. in Level 2, also containing evidence of occupation. Therefore, it is not possible to follow a gradual sequence of floral response to the arroyo cutting which took place in the interim. The pollen record is suggestive of only minor changes in the flora of the area in the vicinity of these two sites. Dissection of the landscape through stream channel cutting may have acted to increase the diversity of plants present, as is evidenced by the increased variety of pollen taxa in the upper levels at both sites.

The study of subsistence through the analysis of macrofloral remains from the fills of seven hearths at 32MZ333 indicates that the hearths were probably being used to bake roots. These hearths were devoid of any definitely carbonized seed remains, but they did contain burned and unburned grass, which may be associated with pit baking. The unburned seeds noted only rarely in these features were probably introduced with the grass, which may have been used to prepare the pit for roasting.

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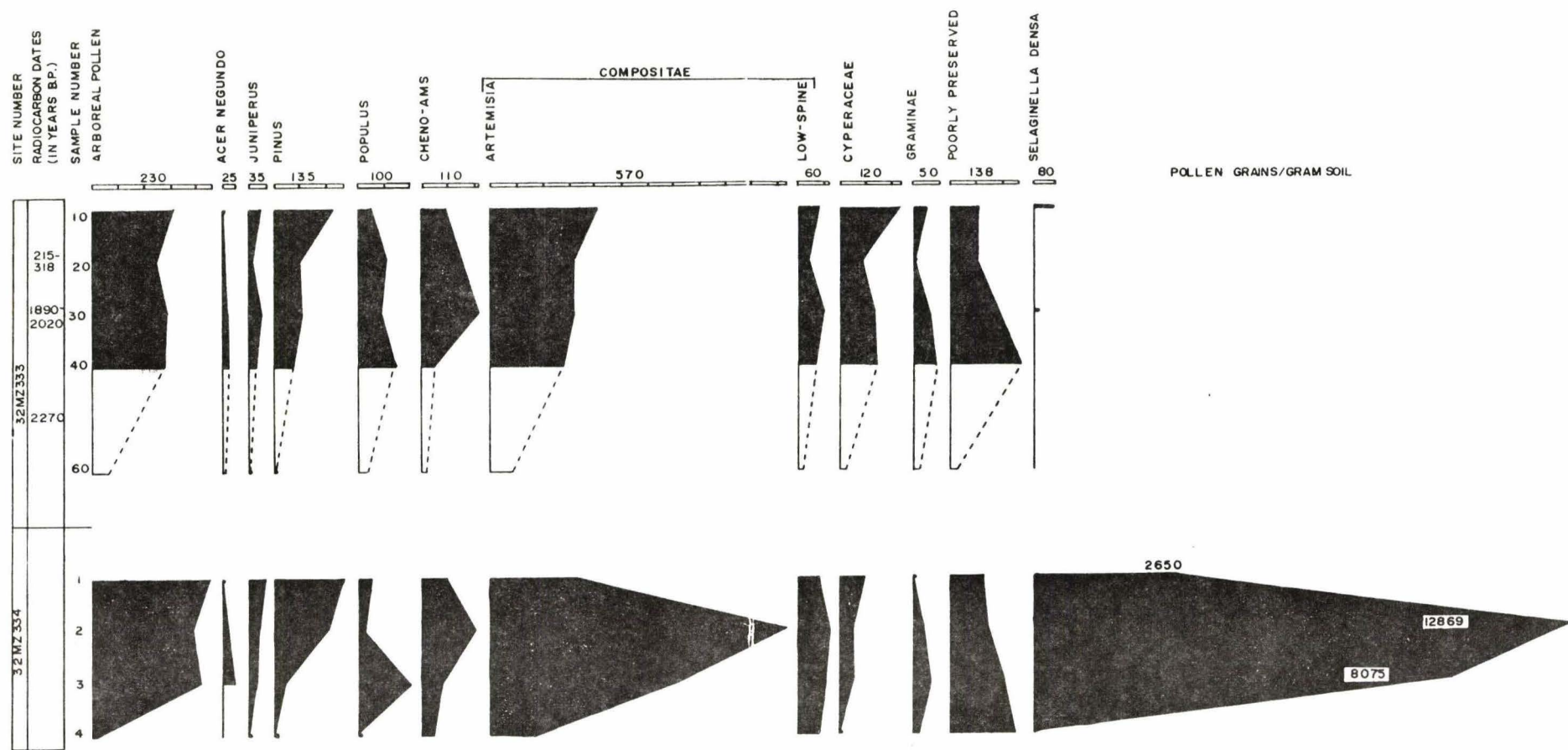


FIGURE 2. ABSOLUTE POLLEN FREQUENCIES FOR SELECTED TAXA FROM 32MZ333 AND 32MZ334.

APPENDIX 7.6

Geological Investigation of Site 32MZ333
McKenzie County, North Dakota

by

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Consulting Geologist
1982

Submitted to Powers Elevation

Geological Investigation of Site 32MZ333
McKenzie County, North Dakota

John P. Albanese

INTRODUCTION

A geologic investigation of archaeological site 32MZ333 was conducted on July 6, 7, and 8, 1982. The site is located in the NE NE of Section 25, Township 148 North, Range 103 West, McKenzie County, North Dakota. This area lies within the U.S. Geological Survey, 7.5 minute, topographic quadrangle sheet "Burning Mine Butte" (Enclosure No. 1). An area that measures 305 x 305 meters was geologically mapped using a plane table and alidade. This investigation was solely a field study. No laboratory work was attempted. Time constraints did not permit a detailed investigation. The work was oriented primarily toward a relative dating of the various soils and land forms.

GENERAL GEOLOGY

Site 32MZ333 lies south of the glaciated portion of North Dakota. Nearly flat lying beds of the Fort Union formation (Paleocene) constitute bedrock within the study area. Bare exposures of bedrock outcrop in approximately half of the mapped area. Bedrock in the remaining portion of the area is covered by a thin veneer of Holocene sediment of post-Altithermal age. The maximum observed thickness of Holocene sediment within the mapped area is 1.2 meters.

The Fort Union formation is composed of a succession of essentially horizontal beds that vary from 30-75 centimeters in thickness. The predominant lithology is grey shale with secondary amounts of tan shale, thin coals, tan bentonite and 5-15 centimeter thick lenses of grey and brown siltstone concretions.

Bedrock has been incised by a rectangular network of ephemeral streams. This rectangular drainage pattern is well displayed on the "Burning Mine Butte" quadrangle map (Enclosure No. 1). The predominant drainage direction is $S61^{\circ}E \pm 14^{\circ}$ (N=16). A secondary stream direction is $N53^{\circ} \pm 22^{\circ}$ (N=15). The shape of the stream pattern is probably controlled by a regional joint system. The prominent drainage divide ridges in the area are

oriented NW-SE, parallel to the predominant stream direction. These bedrock ridges are relatively narrow and characteristically display isolated rounded buttes which project above the general crest line.

GEOMORPHOLOGY, SEDIMENTATION AND SOILS

Within the study area, land forms, sediment and soils are so interrelated that it is not possible to discuss them under separate headings. Thus, for discussion purposes, they are all lumped under the same heading.

The excavated portion of site 32MZ333 is situated along the crest of a small, local ridge which trends N20°W. The ridge is 24 m high and is bounded by slopes which vary in inclination from 18-40°. Bare bedrock is exposed along the eroded slopes which bound the ridge on the northeast and southwest (see Enclosure No. 2). The ridge is bounded on the northeast by a fourth-order, ephemeral stream valley which drains S62°E. The head of a second-order, southwest-draining ephemeral stream lies at the base of the main ridge at a point located 61 m west of the site datum. The second-order ephemeral stream is a tributary of a southwest-draining, fourth-order ephemeral stream (see Enclosures No. 1 and 2).

Within the study area, four geomorphic surfaces are underlain by post-Altithermal Holocene sediment. These surfaces are the main ridge crest which is underlain by eolian sand and three Holocene terraces that border the ephemeral streams.

The crestal portion of the main ridge is capped by 62-107 cm of eolian sand which overlies bedrock. The sand is very fine to fine grained and is well sorted. Generally, the sand has a massive appearance, though vague laminae 1-2 mm thick were observed in some excavation pits. Pedogenesis plus plant root penetration has destroyed most of the original sedimentary structures.

Two soils have developed on the eolian sand unit. These soils are labeled P5 and P4 in ascending order. The P5 is the oldest and most mature soil present within the mapped area. It consists of a 10-48 cm thick, A2 horizon which is dark brownish grey in color plus an underlying Cca horizon that varies from 10-48 cm in thickness. Ped surfaces within the A2 horizon consist of prominent horizontal surfaces which lie 1-2 cm apart and secondary vertical surfaces which lie 2.5-4 cm apart. White

calcium carbonate filaments are a prominent feature within the A2 horizon. The Cca horizon is massive and tan in color. It extends to bedrock. In places, a 15± cm thick transition zone exists between the A2 and Cca horizons. The maximum observed thickness of the P5 soil is 95 cm. The P5 soil is restricted in occurrence to the crest of the main ridge. It does not occur on geomorphic surfaces that are topographically lower.

A Besant style projectile point plus other artifacts and firehearths are present near the base of the A2 horizon of the P5 soil. The P5 soil developed after the Besant occupation. This indicates that it is younger than 1600 years B.P. The presence of the well developed A2 horizon on eolian sand suggests that the soil formed during a relatively "wet" climatic cycle when stable conditions allowed continuous development of a short grass sod.

The P4 soil is the surface soil over the bulk of the main ridge crest. The P4 soil immediately overlies the P5. The contact between the two soils is relatively sharp. The P4 is an azonal soil with a weak A horizon that is light tannish grey in color. This soil is also developed on the aforementioned eolian sand unit. A few siltstone grains, 5± mm in length, were observed within 6 cm of the ground surface in a few exposures. This situation suggests that a few, thin lenses of slope wash sediment are present near the top of the eolian unit. The P4 soil also contains grey lenticular humic bands that are 0.5-1 cm thick. Three is the maximum number observed in any one exposure. The "humic" bands result from the burial of a grassy turf by the eolian sand. The P4 soil varies from 18-25 cm in thickness. Projectile point fragments, possibly of a Late Prehistoric type, plus other artifacts were recovered from the P4 soil zone.

The top of the P4 soil is actually a planar erosional surface which cuts across both the P4 and P5 soils. These soils are completely removed by truncation along the north-east margin of the main ridge (see Enclosure No. 3).

Within the mapped area, the remnants of three Holocene terraces occur along the margins of ephemeral stream valleys. In order of ascending topographic position and age, these terraces are labeled T1, T2, and T3 (see Enclosures Nos. 2 and 3).

Within the mapped area, the T3 terrace is the most restricted in occurrence. It is represented by remnants of the extreme upslope remnants of the terrace tread (see Enclosure No. 3). These T3 remnants are present on the northeast edge of the main ridge, just below the truncated edges of the P4 and P5 soils plus the area to the north. A remnant of the T3 terrace is also present in the southwest portion of the mapped area (see Enclosure No. 2). The T3 terrace is identified by its relative topographic position plus the presence of a light tan, azonal soil which is developed on sandy sediment. This soil is labeled P3 on Enclosures Nos. 2 and 3.

In the area located 15 m north of the site datum, the P3 soil has formed on a 1 m thick deposit of sand. This sand is probably derived from the eolian unit on which the P4 and P5 soils are developed. Here the A horizon is light brown in color and 30± cm thick. In the southwest corner of the mapped area, a remnant of the P3 soil is preserved along the crest of a linear ridge (see Enclosure No. 3). Here a 23 cm thick, light brown A horizon is developed at the top of a 60 cm thick colluvial deposit which rests on bedrock. The colluvium is composed of lenticular, thin bedded (1-4 cm) layers of sand, some of which contain randomly distributed pebbles of sandstone and siltstone. The P3 A horizon is overlain by 10± cm of loose, eolian sand which supports the modern grass cover.

Portions of the T1 and T2 terraces have been removed by relatively recent erosion. These terrace remnants lie both to the northeast and southwest of the main ridge crest (see Enclosures Nos. 2 and 3). The tread of the T1 terrace lies 15-90 cm below the tread of the T2 terrace. The gradients of the terrace treads vary from 0.0584-0.1136 on the T1 terrace to 0.0032-0.0667 on the T2 terrace. A larger area would have to be mapped before any meaningful analysis of the geometry of the terrace surfaces could be made.

In the southwest portion of the mapped area, the T1 terrace is underlain by 20-55 cm of colluvium composed of thin (0.5-1.5 cm), horizontal, lenticular beds of very fine grained, clayey sand with included pebble lenses. The colluvium rests on bedrock. A faint, incipient, very light tan A horizon underlies the T1 terrace tread and is developed on the colluvium. The pedogenic zone is 13 cm thick and essentially consists of the modern grass roots solum.

In the vicinity of instrument station II (southwest portion of map area), 120 cm of colluvium is exposed beneath the tread of the T2 terrace. The colluvium consists of 0.5-3 cm thick, horizontal, discontinuous beds of very fine grained, clayey sand that displays fair sorting. Pebble lenses, 30-60 cm long and 1± cm thick, are a common feature. Individual pebbles are composed of 0.5-1 cm long, angular pieces of siltstone. This colluvium unit is labeled S2 on Enclosure No. 3. At instrument station II, a 20± cm thick, light tan A horizon is developed on top of the S2 colluvium unit and forms the surface soil. This soil is labeled P2.

Butchered bison bone is preserved in a small remnant of the T2 terrace that abuts against bedrock at a point located 165± feet north of instrument station II. This remnant of the S2 unit is 15± cm thick. Mervin Floodman of Powers Elevation reported that relatively large quantities of bone and some artifacts were lying at the surface in the general vicinity of instrument station II in 1981. Floodman also reported that the bone and artifacts had been collected by personnel of the Forest Service.

The P1 - P5 soils serve as useful chronologic markers in the study area. From oldest to youngest, the soils are ranked as follows: P5, P3, P4, P2 and P1. The P4 and P2 soils may be of approximately the same age. They differ somewhat in hue and color but this may be due to the fact that they formed on different materials. The P4 is developed on eolian sand while the P2 developed on clayey, sandy colluvium.

One of the main purposes of this investigation was to determine the age relationship between the bison bones present in the southwest portion of the mapped area and the cultural horizons excavated in the main portion of the site located on the ridge crest. Geomorphic and soil relationships indicate that the bison bone accumulation is younger than the P5 soil which formed after the time of the Besant occupation. The bison were butchered during the Late Prehistoric cultural period. The bones may be of the same approximate age as the artifacts that were present on the top of the ridge within the P4 soil.

An attempt to depict the general configuration of the ground surface within the mapped area, at the time of the Late Prehistoric bison kill, is shown on Enclosure

No. 4. This contour map was prepared using the ground elevations of the T2 terrace tread plus the present elevations of older geomorphic surfaces. The approximation, shown on Enclosure No. 4, indicates that at the time of the bison kill, the ground surface in the vicinity of the bison kill was a broad, $3\pm^\circ$, west facing, colluvium covered slope. This slope was bounded on the east by a $10^\circ\pm$ west facing, eroded, bedrock slope. A topographic depression, pronounced enough to form a bison trap, is not evident. Just how the Late Prehistoric Indians were killing the bison remains open to further discussion. Some procurement technique, other than use of a topographic depression, must have been employed.

CONCLUSIONS

Geologic field investigations indicate that the ground surface in the general vicinity of site 32MZ333 has undergone pronounced changes since the time of the occupation by the Besant peoples. Much of the original hill slope, adjacent to the ridge on which the Besant camp site is located, has been removed since the time of the Besant occupation. The channels of the ephemeral streams, which border the main ridge on which site 32MZ333 is located, have been lowered 6-7.6 m since the time of the Besant occupation.

At the time of the Besant occupation, the ground surface was more undulating than at present. Slope angles were less pronounced and stream channels probably occupied swales rather than the arroyo-like features which exist at present. The climate was as semi-arid as the present as witnessed by the presence of eolian sand on the crest of the main ridge. A "wet" cycle followed the Besant occupation and the P5 soil was formed. This event was followed by a switch to more arid conditions, a situation that has continued with some interruptions to the present time. The evidence for this latest arid cycle is furnished by the 6-7 meter deepening of the ephemeral stream channels (see Enclosure No. 3). This deepening of channels could not have occurred unless the regional water table was also correspondingly lowered. Streams will not incise their channel below the water table. Interruptions in the overall regional deepening of stream valleys occurred during the creation of the T1 and T2 terraces when depositional processes become dominant. The area is currently being subjected to erosion and portions of the T1 and T2 terraces are being destroyed. Thus, in the past 1600 \pm years since the

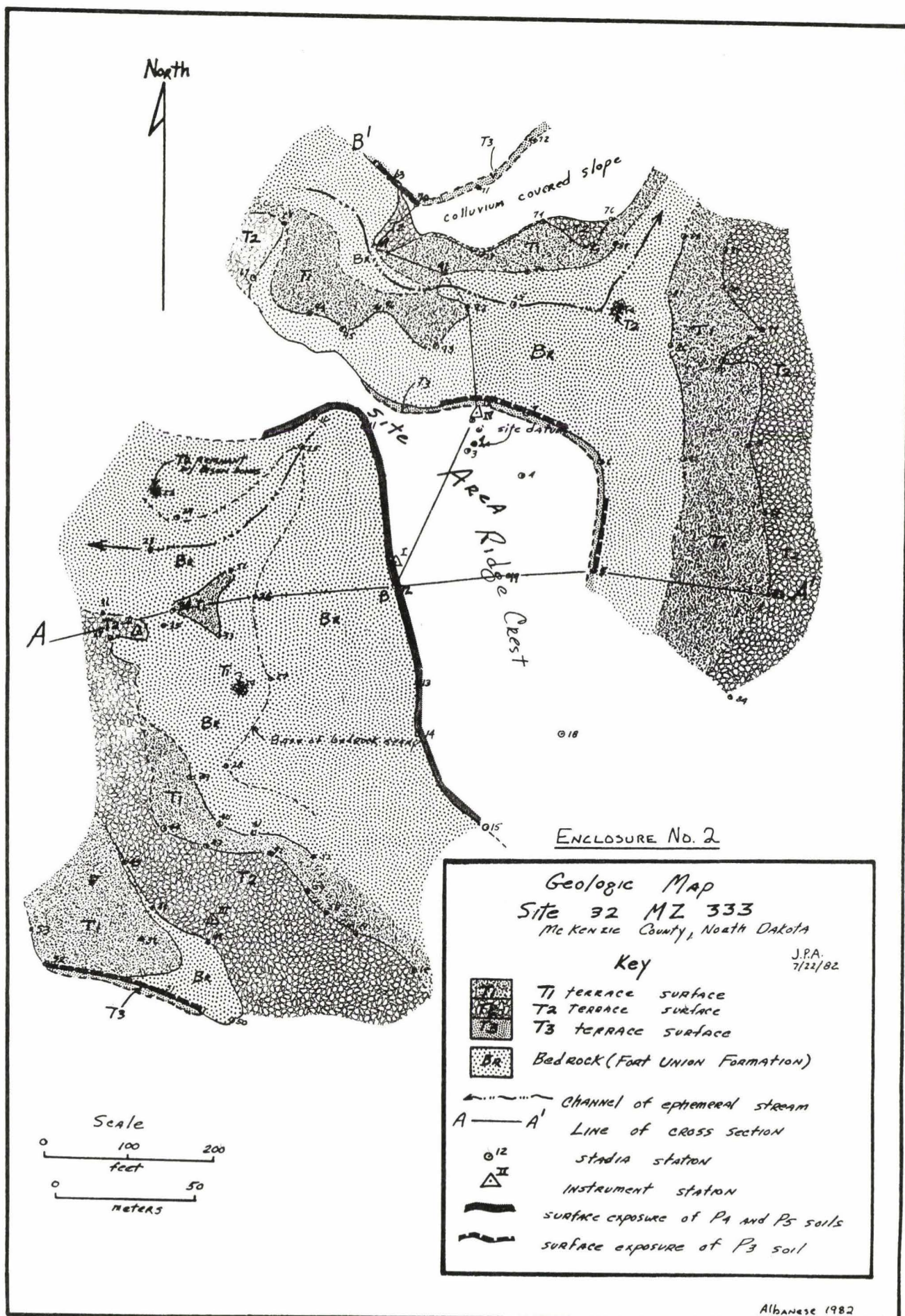
time of the Besant occupation, the landscape has been subjected to much modification. The lowering of the ground water table and resultant downcutting since the time of the Besant occupation may be a regional happening. A similar event can be documented in the Powder River Basin of Wyoming at the Ruby site (Albanese 1971) and site 48CO452 (Albanese 1982). Both sites contain buried Besant cultural horizons. At site 48CO452, good documentation indicates that the major downcutting cycle was inaugurated approximately 1000 years ago.

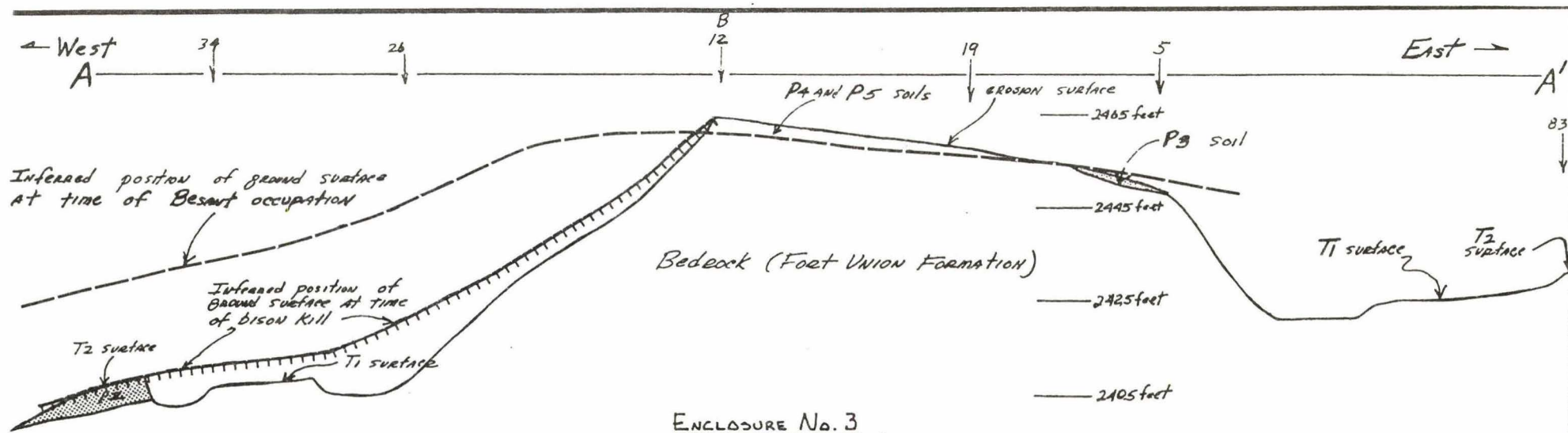
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Albanese, John P.

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Missoula, Montana.





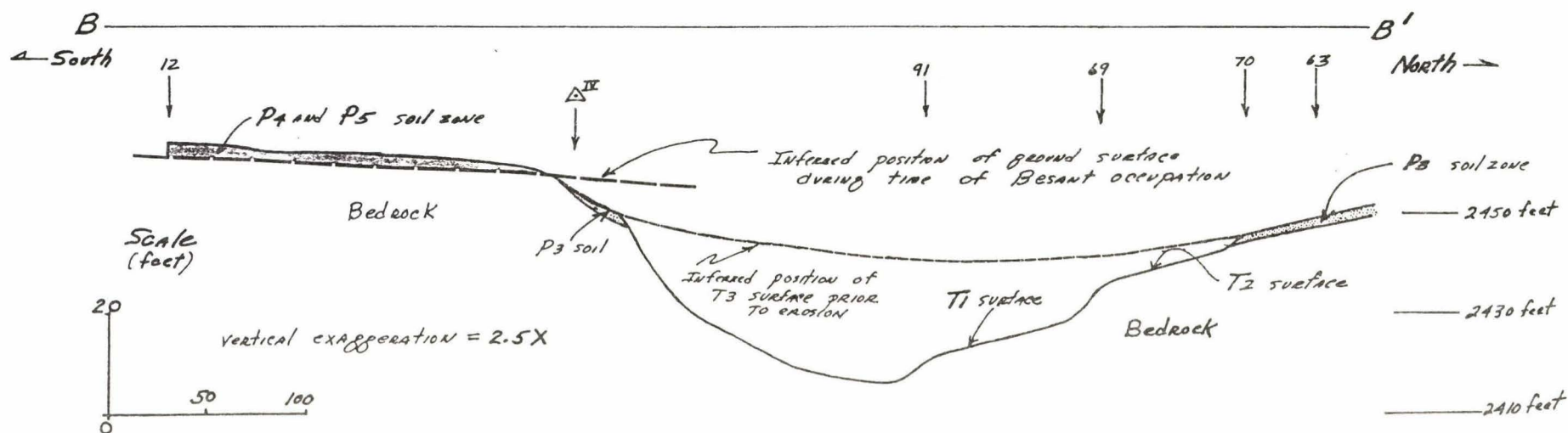
ENCLOSURE No. 3

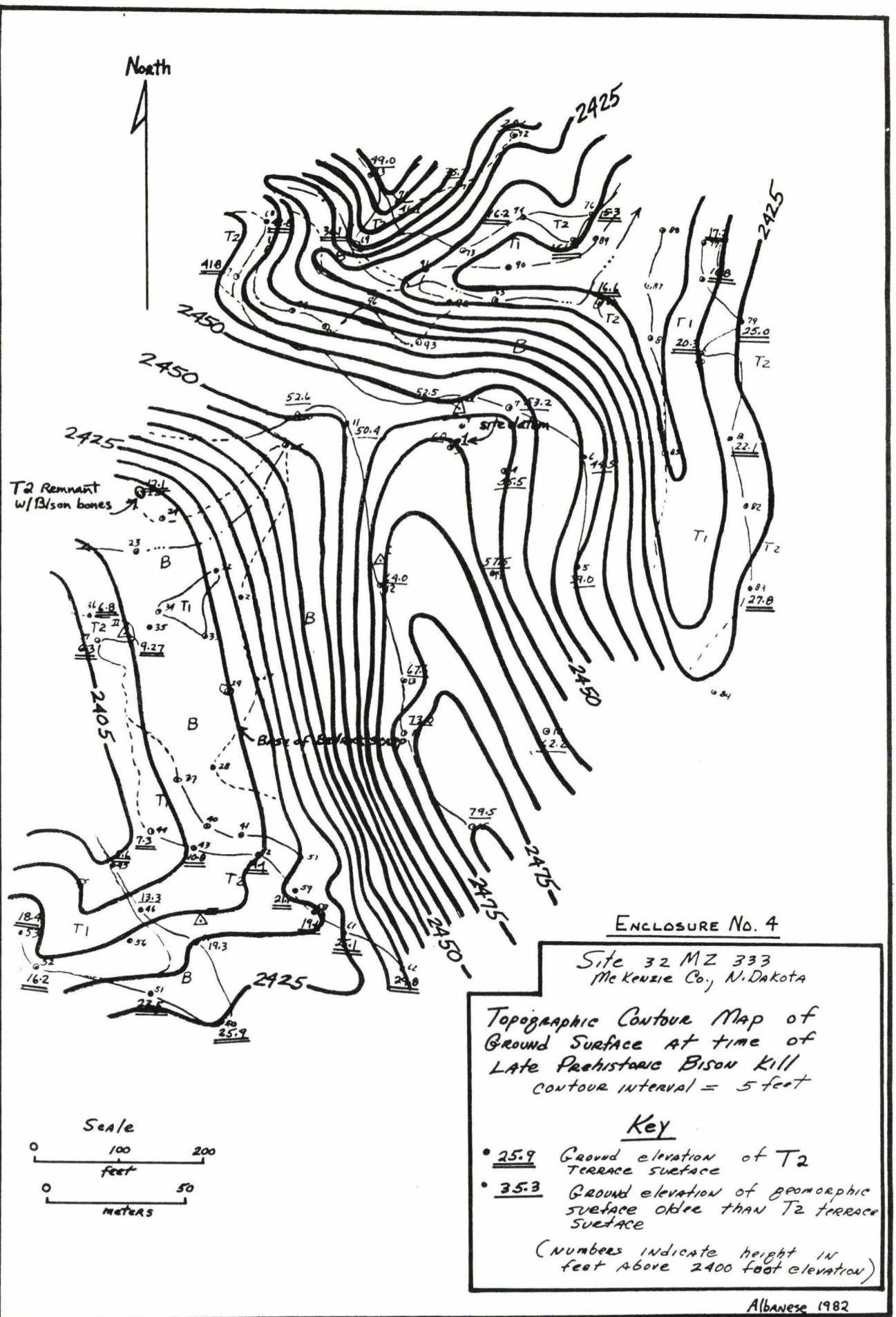
Cross Sections A-A' and B-B'

site 32 MZ 333

McKenzie Co., N. Dakota

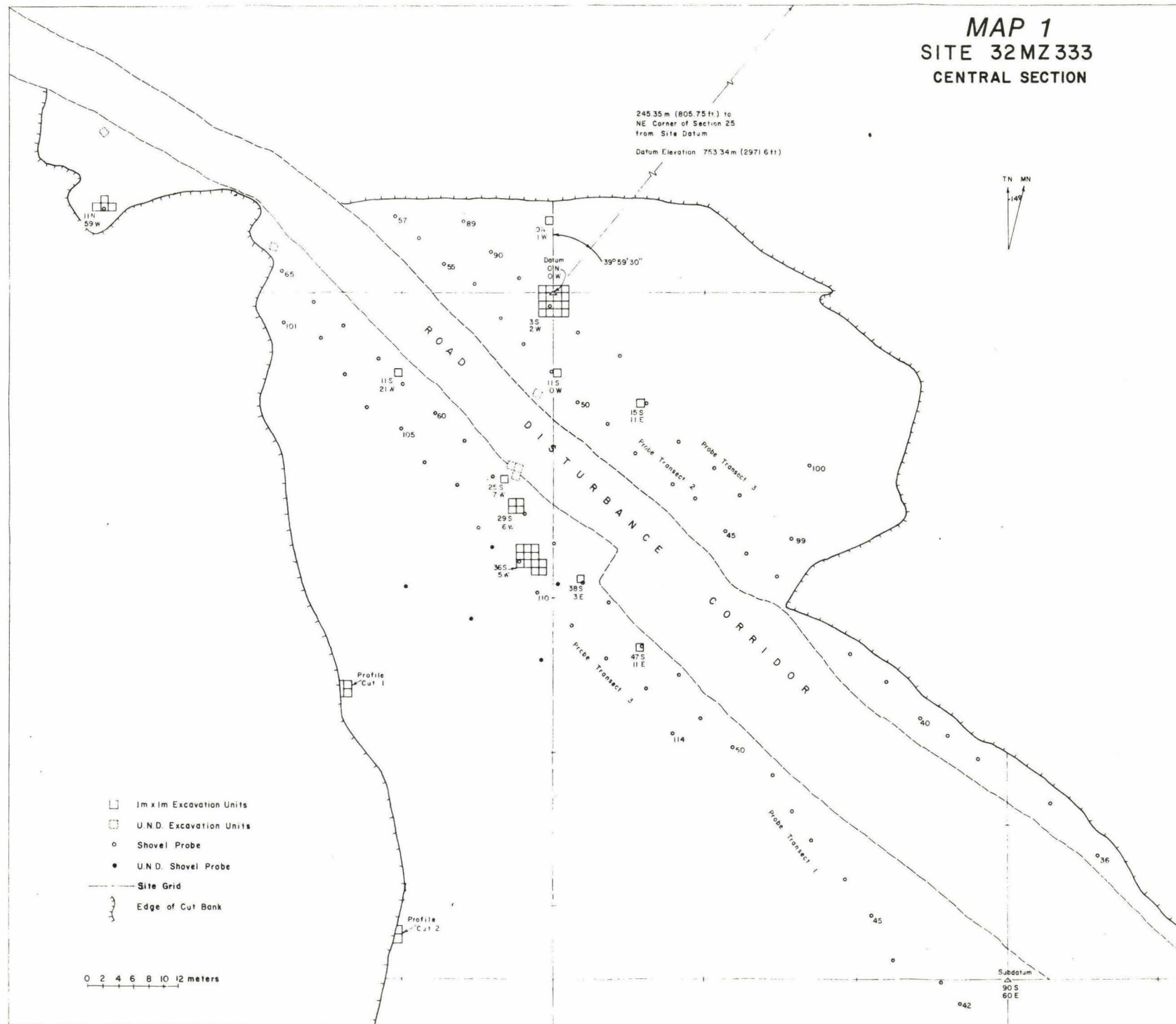
Albanese 1982





MAP 1 SITE 32MZ333 CENTRAL SECTION

245.35 m (805.75 ft.) to
NE Corner of Section 25
from Site Datum
Datum Elevation 753.34 m (2971.61 ft.)



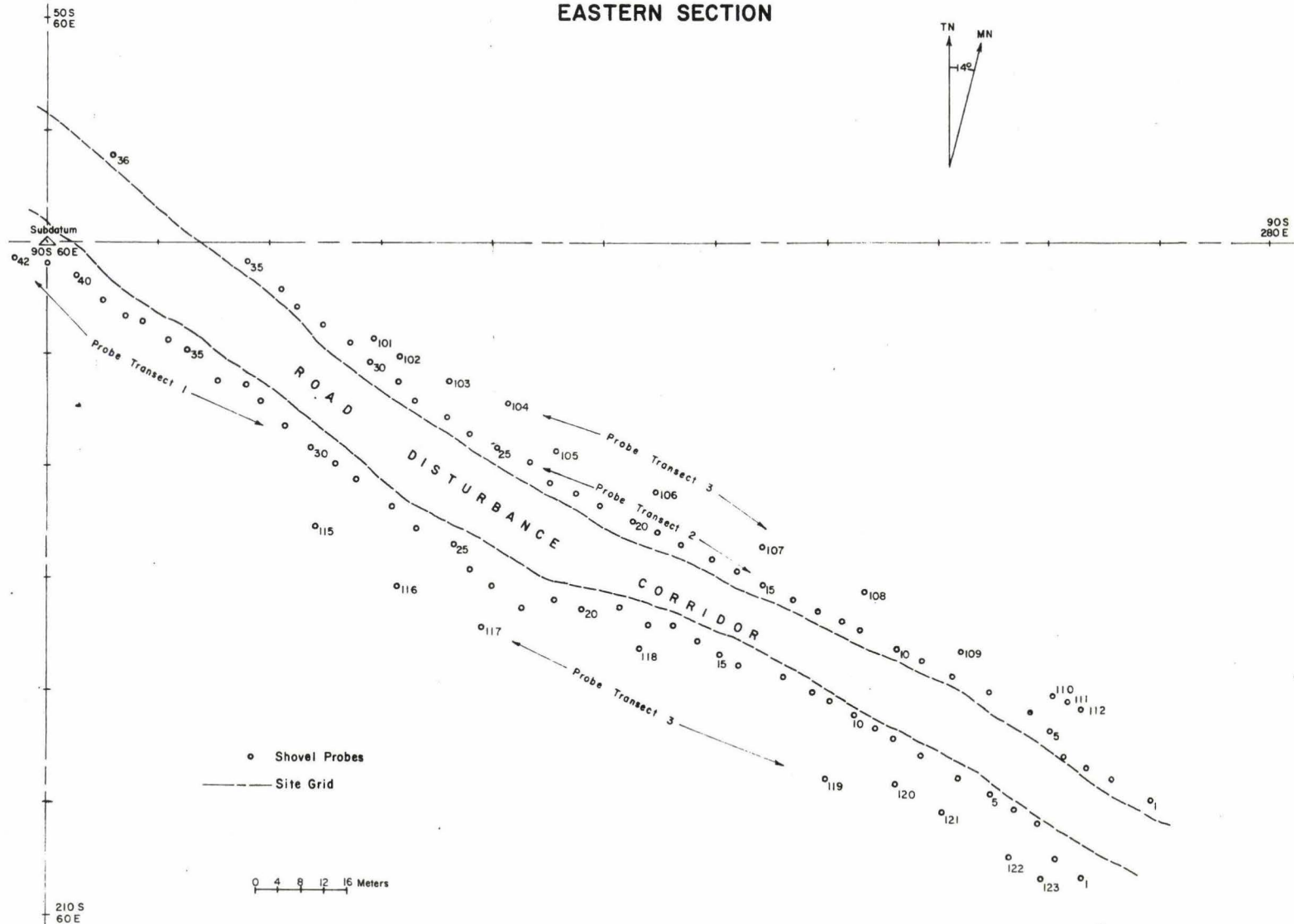
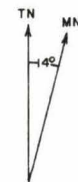
- 1m x 1m Excavation Units
- U.N.D. Excavation Units
- Shovel Probe
- U.N.D. Shovel Probe
- Site Grid
- Edge of Cut Bank

0 2 4 6 8 10 12 meters

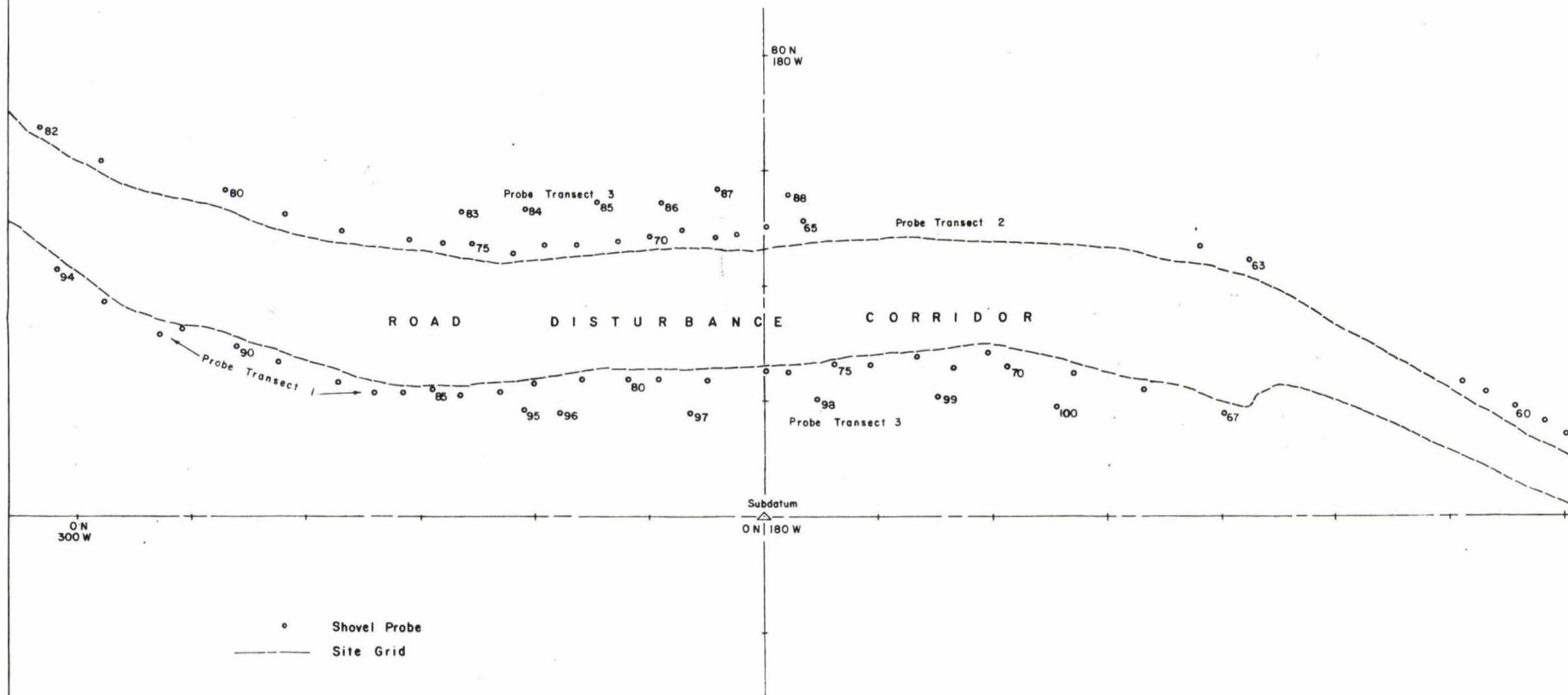
MAP 2

SITE 32 MZ 333

EASTERN SECTION



MAP 3
SITE 32MZ333
WESTERN SECTION



MAP 4

SITE 32MZ334

